1927

THE RUBBER AGE

VOL. 21 No. 1

AN ULTRA ACCELERATOR

for

Nearly Any and Every Need

●

That's a broad statement; sounds a bit like gross exaggeration or a very free use of superlatives.

But the fact remains that either TUADS or one of the ZIMATES, properly used, will satisfy splendidly nearly any reasonable requirement that may be made of an ultra accelerator, particularly in low sulfur compounds for improved aging and more uniform curing.

The use of TUADS and the ZIMATES grows yearly for making better goods, with fewer troubles.

●

R. T. VANDERBILT CO., 230 PARK AVENUE, NEW YORK

KEEP ON THE RIGHT SIDE

with NEOPRENE *products*

IF YOU give your customer his money's worth, he will continue to give you his business. In some cases, the only way to give him the quality he needs is to make your product with NEOPRENE—where conditions are too severe for natural rubber.

NEOPRENE is durable under conditions which cause natural rubber to deteriorate rapidly. It resists heat, sunlight, oils, and aging. At the same time, it is the only material which equals rubber in resilience, strength, and toughness.

It will pay you to tell your customers about the superior performance of NEOPRENE products. He will willingly pay the difference for extra quality.

Make your service complete by including NEOPRENE products in your line.

DU PONT
REG. U. S. PAT. OFF.

NEOPRENE

(Formerly sold under the trade mark "DuPrene")

Our technical staff will gladly cooperate in problems of design and compounding

E. I. DU PONT DE NEMOURS & CO., INC., RUBBER CHEMICALS DIVISION, WILMINGTON, DEL.

THE RUBBER AGE, published monthly by The Palmerton Publishing Co., Inc. Printing Office, East Stroudsburg, Pa. Editorial and Advertising Offices at 250 West 57th Street, New York, N. Y. Entered as second class matter October 20, 1933, at the Post Office at East Stroudsburg, Pa., under the Act of March 3, 1879. Subscription in United States, $2.00 a year; Canada, $2.50; Foreign, $3.00. APRIL, 1937. Vol. 41, No. 1.

Books Published by THE RUBBER AGE

LATEX AND ITS INDUSTRIAL APPLICATIONS, by Marchionna (Vol. I) **$15.00***

LATEX AND RUBBER DERIVATIVES AND THEIR INDUSTRIAL APPLICATIONS (Vol. II and Vol. III), by Marchionna **$20.00***

(Combination Price: Vols. I, II and III .... $30.00*)

The only bibliography on all patents and published literature on Latex. Complete, authoritative and thoroughly indexed. Indispensable to users of Latex.

LATEX IN INDUSTRY, by Noble ..... **$ 7.00***

A comprehensive text book covering all phases of the technology of Latex and its present-day uses in industry. Complete, practical, indexed and illustrated.

BIBLIOGRAPHY OF RUBBER LITERATURE for 1935, compiled by Cable..... **$ 1.00***

The first issue of an annual series of bibliographies covering the preceding year's literature. Also contains a Directory of Rubber Chemicals by Brand Names, Uses, etc.

* Add 2% for Sales Tax on copies sent to N. Y. City addresses.

THE RUBBER AGE • **250 WEST 57th ST., NEW YORK**

In the lead for more than 40 Years

GUMMI-ZEITUNG

Trade Journal for the

RUBBER, GUTTA PERCHA, ASBESTOS, CELLULOID and Allied Industries

Central Organ for the Whole German Rubber Goods Industry

Published Every Friday

SUBSCRIPTION RATES

In United States .....RM 32
Domestic .....RM 24

Sample copy free

WORLD WIDE CIRCULATION

Main Office of GUMMI-ZEITUNG
Berlin SW 19, Krausenstrasse 35/36

Best Advertising Results for all those desiring to make trade connections in Germany in this field.

REVUE GÉNÉRALE DU CAOUTCHOUC

A monthly review edited by the Rubber Association,

18 rue Duphot, Paris, (1er)

Only officially accredited publication in France

CONTAINS ORIGINAL CONTRIBUTIONS FROM FRENCH TECHNOLOGISTS. TECHNICAL AND COMMERCIAL INFORMATION, NEWS OF THE RUBBER TRADE.

Price of annual subscription: 80 Frs.

Specimen copy sent free on request

All Rubber Technologists should read:

THE ENCYCLOPAEDIA of the RUBBER AND ALLIED INDUSTRIES

25 collaborators — 500 pages — 300 illustrations. Edited by the Rubber (and allied industries) Association, 18 rue Duphot, Paris (1er) — Preface by M. Ch. Jung, President of the Association, Member of the Chamber of Commerce

Price: 125 Francs ($5.00)

The Rubber Age

Published Monthly at East Stroudsburg, Pa.
Editorial and Advertising Offices: 250 W. 57th St., New York

Vol. 41 APRIL, 1937 No. 1

Statex Rubber Thread

Many Advantages Are Claimed for New Rubber Thread Made with Destructible Core of Natural or Synthetic Fibre

By Otto Pennenkamp

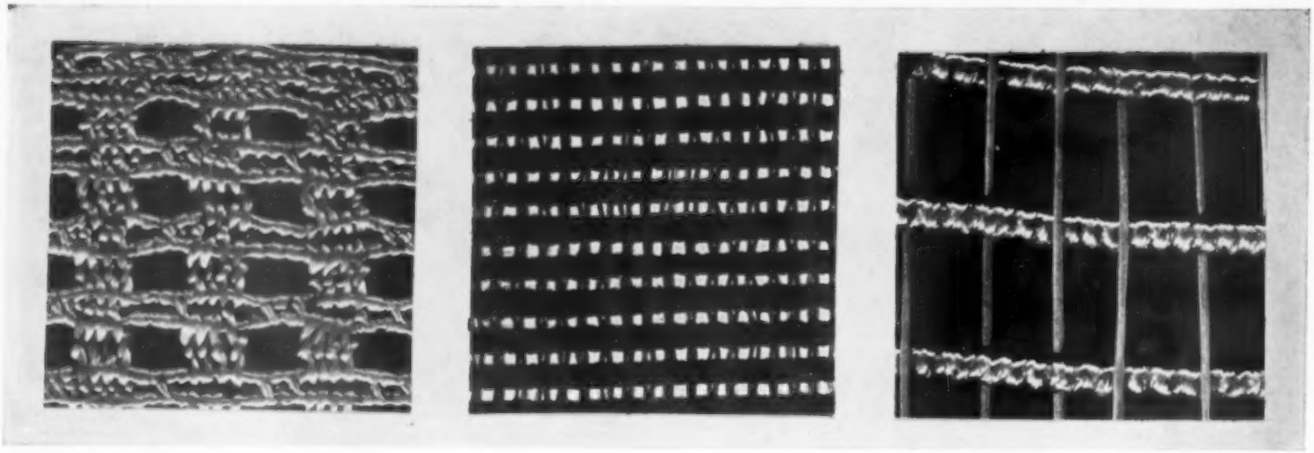
RUBBER thread has advanced through many stages in the past several years and has proved of exceptional value to the clothing and textile industries. Not only has the usual square cut rubber thread been improved in quality and finer types made available, but new processes have been introduced that make it possible to obtain highly elastic threads direct from latex or suitable rubber solutions by forcing the rubber substances through nozzles and then coagulating and vulcanizing the resulting latex and rubber threads. These achievements have provided the weaving, knitting and plaiting branches of industry with new possibilities for varied patterns and have indirectly opened new markets.

One of the latest developments is the Statex thread, the manufacture of which differs considerably from that of all other kinds of rubber thread. According to the new process (German Patent 613,235), threads of natural or artificial textile material are coated in the known manner with a rubber compound containing vulcanizing additions, and after the coating has been vulcanized the core threads are removed by solution in acetone. Alternately, threads of vegetable or artificial fibre may be penetrated with a carbonizing agent or an acid salt or alkali and dried and destroyed by heat after the solution has been applied. The products may be woven, knitted or plaited before the core threads are removed.

This process for producing rubber threads undoubtedly offers the advantage of making it possible to use rubber threads which are constantly uniform and which have almost absolutely constant tension. As it is not always possible in the production of elastic rubber articles to avoid differences of tension with the usual rubber and latex threads in the course of the numerous operations, it is expected that the Statex thread will bring many improvements in manufacturing, improvements that will counterbalance any additional costs that may be incurred. The process is of particular interest when it is considered that certain elastic articles, such as those having a weft of rubber thread, require a tension of the rubber material that can be regulated exactly.

In the production of Statex thread, the core threads may be covered with rubber by many different methods, for example, by spraying or dipping or passing the core threads through a nozzle which is simultaneously supplied with the coating substance such as latex. This operation of coating core threads with rubber may be effected by calibrating the nozzles, or may be repeated several times in succession, as required, for the purpose of obtaining rubber threads of a greater diameter.

This is followed by a drying and vulcanizing process suitable for the initial covering material, but in this case the rubber does not need any additional coagula-



Close-up view of elastic bobbin lace composed of artificial silk and Statex thread.

Elastic fabric with an artificial silk-covered artificial silk warp and Statex weft.

Extended state of bandage with naked Statex warp and artificial silk-covered Statex weft.

tion. If the rubber layer surrounding the core thread has been sufficiently strengthened by vulcanization, the dissolution or structural destruction or removal of the core threads may take place at any desired moment. As a rule it takes place after the stable rubber thread has been worked up into articles, so as to obtain the desired elastic rubber thread.

As stated, the destabilizing operation may take place by dissolving the core thread through the action of a caustic or solvent, for example, by passing the Statex thread through a suitable bath that causes dissolution or decomposition and the removal of the constituents of the core thread without attacking the rubber thread proper. Acetone or a mixture of methylene chloride and methyl alcohol are suitable for this purpose where core threads are used consisting of acetyl cellulose such as acetate silk or acetate cellulose wool. Such a treatment has the additional advantage of not only giving the thread the desired elasticity, but of washing out, by means of the solvent, any excess of sulphur and accelerator that may have remained in the rubber in consequence of the osmotic pressure arising in this treatment.

Dissolution of the core thread may also be brought about by means of carbonization. In this case the core threads consisting of natural or artificial fibres are treated with acid substances or lye and dried. After having been coated with rubber and vulcanized, it is possible to break down or dissolve the structure of the core thread by means of heat or light. As in the case of the previously mentioned destructive treatment it may also be of advantage here to resort to a subsequent treatment with solvents in order to remove any residues of core that may have remained in the interior of the rubber threads.

The raw material for coating may be any of the initial rubber substances known and used in the production of rubber threads, e.g., solution of crude rubber in organic solvents or natural or artificial rubber dispersions, which, if required, may be mixed with fillers and pigments, vulcanization agents, vulcanization accelerators, or the like.

Another advantage of this invention is that it offers the opportunity of making the threads elastic at any moment and at any point. This creates new possibilities for their uses and applications. The Statex threads, before being worked up to form elastic articles, may be covered on a spinning machine with other threads consisting of natural silk, wool, cellulose wool or artificial silk. Naturally, in all such cases a method of subsequently destroying the structure of the core threads must be chosen by which the core thread alone is removed, but which attacks neither the rubber nor the material spun around it nor the textile material employed.

The present invention for producing rubber threads constitutes an extension of the industrial methods for producing such threads. As the modern textile and clothing industries, as well as the industry manufacturing elastic articles, are very versatile in their methods of manufacturing, the fabrication of rubber threads had to follow with its methods of production. The various rubber threads require an individual fashioning and application in accordance with the purposes for which they are intended. The present development appears to be a step forward in this direction.

Thiokol Parts in Giant Scale

INCORPORATION of synthetic rubber parts, in this case made of Thiokol, makes possible efficient operation of the world's largest automatic liquid weighing scale, recently delivered to the Government of Cuba. The scale is intended for weighing cargoes of oil and gasoline to provide a more accurate basis for the levying of import duties.

The big scale weighs 27,500 pounds of oil and gasoline each minute. The liquids are conveyed from a feed pipe to two large floating tanks and any resistance to the delicate movement of the weighing tanks, which are mounted on scale levers, would seriously affect the accuracy of the scale. This resistance is precluded by the use of 12-inch Thiokol hose, which is both flexible enough for the purpose desired and answers to the gasoline-proof factor required. For this same reason, leakless, gasoline-proof synthetic rubber valve seat discs were adopted, these discs permitting and assuring instantaneous stoppage of the liquid flow at exactly the proper moment.

Although the contract guarantee permitted an error limit of 1/10th of 1%, tests conducted revealed that the scale registered an error of less than 1/900th of 1%. The scale was manufactured by the Richardson Scale Company, and the Thiokol parts were produced by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.

Reclaimed Rubber

By Henry F. Palmer

Chief Chemist, Xylos Rubber Company

DURING the past decade reclaimed rubber has acquired a place as an essential compounding ingredient in many types of rubber compounds and for this reason deserves the earnest consideration of every rubber compounder. The subject of reclaimed rubber will be discussed under the following general topics:

I. General Statistics.
II. Raw Materials.
III. Methods of Manufacture.
IV. Theory of Devulcanization.
V. Types of Reclaimed Rubber.
VI. The Uses of Reclaimed Rubber.
VII. The Testing of Reclaimed Rubber.

General Statistics

The purpose of reclaiming scrap rubber is to produce a marketable product at a profit. This is, of course, the fundamental principle in the production of any material. Reclaimed rubber may be defined as the product resulting from the processing of vulcanized scrap rubber. It is a compounding ingredient and an auxiliary to crude rubber in the manufacture of many kinds of rubber goods. Reclaimed rubber may be called "domestic rubber" since it is manufactured chiefly within a reasonable distance of its point of use, whereas crude rubber leaves the consumer entirely dependent on a raw material, the production of which is very far removed.

It is of some interest to study the relationship of the prices of crude and reclaimed rubber and their relative consumption. It will be seen from Figure 1 that in 1925 the price of crude rubber averaged approximately $.72 per pound and in the same year the ratio of consumption of reclaim to crude was 35%. Beginning at that time the price of crude rubber dropped continuously until 1932. However, the ratio of consumption increased to a maximum in 1927 and 1928 when in the latter year the price of crude had dropped to $.22 per pound. Beginning at that time the ratio decreased until 1933 when it was low at 20%.

It is important to note that while the price of crude rubber dropped from a yearly average of $.72 per pound to $.03 per pound, the ratio of consumption at first increased and then decreased to only 20%. One should notice the relatively firm curve for the price of reclaimed rubber at that period. In 1932 whole tire reclaim actually sold at a higher price than No. 1 smoked sheets. All of this indicates the entrenched position which reclaimed rubber has achieved as a raw material in the manufacture of rubber goods.

In Figure 1 is also a curve showing the year by year production of reclaimed rubber. It reached a high in 1929 of 218,954 long tons and then dropped to 75,608 long tons in 1932. The figures for December, 1936, were estimated in making the summation for the year.

Just what is the value in dollars and cents of a pound

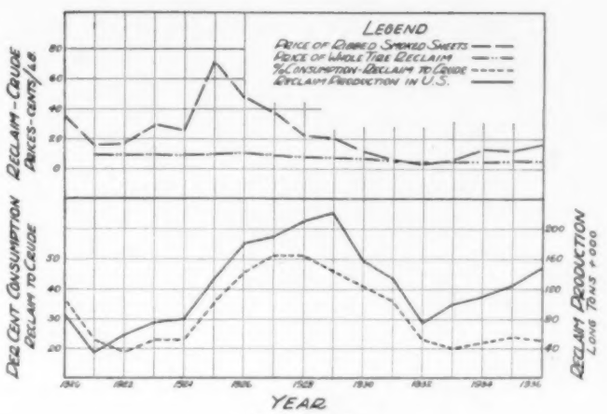


FIGURE 1.

of whole tire reclaim relative to a pound of No. 1 smoked sheets? The following work (reproduced by permission of the Naugatuck Chemical Division of U. S. Rubber Products, Inc.) illustrates this very well. Formula 1 was developed as a substitute for reclaim.

FORMULA 1

Smoked Sheets	100
Mineral Rubber	50
Gilders Whiting	41
Zinc Oxide	5
Heptene	0.6
	196.6
Specific Gravity	1.13

This compound will give about the average ash and acetone extract of a whole tire reclaim. It was com-

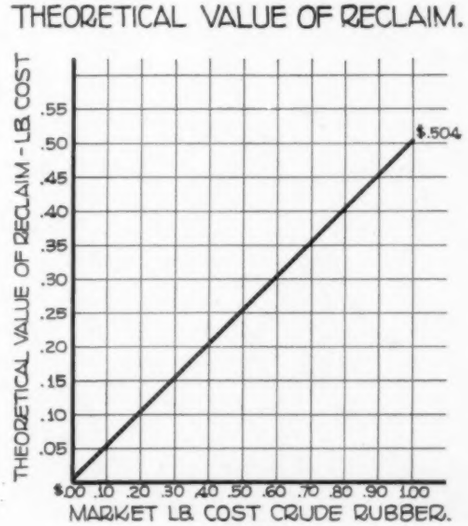


FIGURE 2.

This article is a digest from a lecture delivered by the author before the Rubber Division, Toronto Chemical Association, at a meeting held on January 22, 1937, in Toronto.

pared with whole tire reclaim in two carcass compounds containing approximately 40% and 65% of reclaim, or reclaim substitute, and in a tread compound containing 13% of reclaim or reclaim substitute. The test results are very comparable, including flexing and abrasion tests which show that Formula 1 can be used for determining the price relationship of crude and reclaimed rubber. Assuming that the prices of the other ingredients in Formula 1 are constant, one can arrive at the figures shown in Figure 2. It will be seen that when the price of crude rubber is $.23 per pound, whole tire reclaim should be roughly ½ this or $.11½ per pound if it is priced at its full compounding value. The present price of whole tire reclaim is $.0575 per pound, or ½ of this figure. What an excellent value this is cannot be fully appreciated until a discussion of many other advantages and economies resulting from its use are discussed later.

Raw Material

Any scrap rubber article may be considered as raw material for the manufacture of reclaimed rubber. A simple classification of the different types of scrap is shown in Table 1. Scrap rubber is obtained either from worn out or discarded rubber articles. These items are usually handled by brokers who in turn buy from local dealers and factories. The brokers who handle the scrap last must classify and grade it according to the detailed "Standards of Scrap Rubber Specifications" published by the Rubber Reclaimers' Association, Inc. These specifications attempt to grade the scraps as well as possible according to type and quality. There is, however, considerable variation in the age of the scraps and this variation greatly influences processing through the reclaiming plant and necessitates a rigid factory control. The reclaimer has overcome this problem and now produces a uniform product from a very non-uniform raw material.

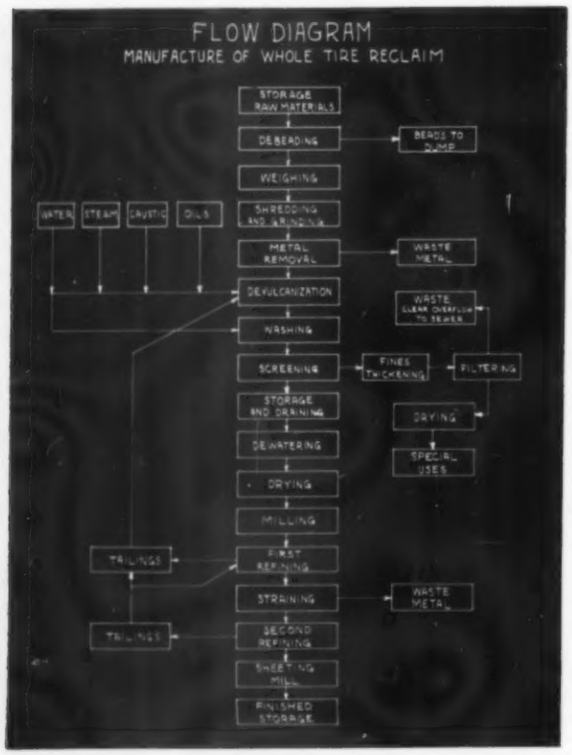


FIGURE 3.

TABLE 1

SCRAP RUBBER CLASSIFICATION

A. *Those Containing Fabric:*
1. Automobile and other pneumatic tires.
   (a) Parts of these tires.
2. Airbags.
3. Boots, shoes, etc.
4. Mechanicals and sundries.

B. *Those Containing No Fabric:*
1. Inner tubes, bus and passenger.
   (a) Red, gray and black.
2. Solid or motor tires.
3. Airbags.
4. Mechanicals and sundries.

Methods of Manufacture

The various types of scrap to be reclaimed and also the type of product to be made will determine which of several methods shall be used as the manufacturing process. These processes may be enumerated as:

(1) The alkali digestion process.
(2) The water digestion process.
(3) The acid process.
(4) The open steam process.
(5) The mechanical process.

The alkali digestion process will be discussed and illustrated in some detail, whereas in the remaining processes the important operations will be only briefly described.

The Alkali Digestion Process:

The method commonly used in the reclaiming of rubber is known as the alkali process. This process was patented in 1899 by A. H. Marks and derives its name from the fact that the fabric is removed from fabric bearing scrap, chiefly whole tire scrap, by means of caustic soda.

Figure 3 gives a flow diagram of the principal operations involved in the alkali digestion process. Figure 4 shows a group of photographs illustrating many of these operations.

The scrap tires are received from the brokers in box cars and occasionally by truck. The magnitude of one tire pile may be seen in Figure 4. Beads are removed from the scrap tires by debeading machines of which there are several types. The debeaded tire is then ground by passing it through cracker rolls and past rapidly rotating knives in order to comminute the scrap so that it will be in a condition suitable for digestion under pressure with caustic soda. The degree of fineness to which the scrap is ground influences to a large extent the thoroughness of the subsequent heating and plasticizing operation, since a uniformly ground and finer scrap will offer a much greater surface per unit weight. After the scrap is ground, it is passed over magnetic separators which remove a large percentage of the magnetic metal, such as steel.

The next step is the treatment of the scrap in autoclaves. These machines are steam-jacketed vessels equipped with stirring devices and having a capacity of two to four tons of ground tire scrap. In the digestion, solutions of caustic soda of from 4 to 8% strength are used together with oils or swelling agents as required. The strength of the caustic soda solution is determined by the temperature, pressure and duration of the heat treatment.

Different oils and swelling agents have specific effects on the final product and are chosen for these results. Generally speaking, a neutral oil used

at this point gives a flatter and less nervy final product, whereas a saponifiable oil makes the product seem to have more body and nerve. This effect is due to the soap formed during the digestion. The pressures used may vary from 160 to 200 pounds per square inch, and the time from 8 to 24 hours. The longer times are used for bus or giant tires which are in general less aged and consequently tougher and require a more drastic treatment.

After the digestion, or "devulcanization" as it is incorrectly called, is completed, the scrap is blown under pressure into wash tanks and thence over de-watering screens in which process it is washed free of residual caustic and dirt. A considerable amount of fine partially hydrolyzed cellulose passes through the de-watering screens. This material is thickened continuously and thereafter filtered on a rotating drum filter. After its recovery, it may be dried and used in special products. The digested and washed scrap is then passed through a squeezing press to remove as much water as possible before it is dried. It is necessary to control the washing and de-watering operations in order to remove all foreign material and also to keep a uniform residual alkalinity. The effect of this alkalinity will be discussed later.

The digesting operation is intermittent, a considerable quantity of material being discharged at one time, and it has been found necessary to have storage bins from which the digested and washed scrap is fed manually into the dryers. Automatic feeders have not been particularly successful. The dryers in common use are belt dryers utilizing temperatures of from 200° to 250°F. Depending upon its type, the scrap is usually dried to a moisture content of 3 to 5%.

The finishing operation in the reclaiming of rubber is one requiring careful attention. The dried scrap is first milled either on an open roll mill or in an internal mixer for the purpose of further plasticizing. During this operation, it is sometimes desirable to add certain ingredients to give the reclaimed rubber specific properties. After the milling operation, the massed slabs are given a first pass through a refiner. A refiner is similar to a two-roll mill, the rolls usually being 30 to 36 inches long and capable of being squeezed together with enormous pressure in order to compress the particles of rubber into a very fine sheet. In order to produce a uniform sheet the refiner rolls have crowns correctly determined by test and continually kept to specification. The roll surface temperature should be between 180° and 210°F. for best results of quality and production.

During the first refining operation, this sheet may have a thickness of .010 in., and in the final operation, it may be from .002 to .005 in. The refining operation derives its name from the fact that any hard, unsoftened pieces of scrap are left behind in the "bite" of the rolls or are passed out at the edges of the rolls, the unrefined pieces being called "tailings." These "tailings" are quite dry and hard and must be re-worked through the devulcanization process.

After the first refining, the scrap is usually in condition to be strained; that is, it is put into a machine equipped with a barrel and screw, similar to a tubing machine, which forces the scrap through a fine screen to remove the non-magnetic metals such as brass and copper and the last traces of the steel. These screens generally have openings of from .015 to .025 in.

The final refining operation is then performed, giving a thin uniform sheet of rubber which is wound on a rotating drum to a given thickness, after which it may be cut to form a square flat slab. These slabs are dusted with powder to prevent them from adhering.

Occasionally after the last refining operation the slabs are passed through a sheeting mill purely for the purpose of blending and putting them in condition for shipment. The objection to this procedure is that it covers up any roughness which may have been present in the original slabs, whereas the slabs direct from the refiner are very easily inspected.

THE WATER DIGESTION PROCESS:

In the processing of scrap which does not contain fabric, such for example as airbags, the same process may be applied as outlined above except that caustic soda is not used and the washing process may be minimized.

THE ACID PROCESS:

In order to impart certain qualities of inertness and dryness to whole tire scrap and boot and shoe scrap, it may be subjected to what is commonly known as the "double process" or "acid process." Two separate operations are involved for the removal of fibre and the plasticization. The scrap is prepared as usual but is first digested in sulfuric or hydrochloric acid for the purpose of removing the cellulose. This operation is carried out at low temperatures in open tanks and after digestion, the acid is removed by washing and neutralization, followed by further washing and riffling.

In riffling, the scrap plus wash water passes through a long trough equipped with cross pieces or riffles which hold back the dirt and metal during the passage of the scrap down the trough. This whole operation of washing and riffling also removes the water-soluble materials, thereby giving a product which offers greater resistance to water absorption.

If desired, the defiberized scrap may be ground and further washed. It is then dried and treated by the pan or open steam process described below. Occasionally the plasticized scrap is further washed to remove any soluble soaps formed during the steam treatment. The finishing, straining and refining operations are carried out in the same manner as described for the alkali digestion process.

THE OPEN STEAM PROCESS:

The open steam (or pan) process is used chiefly on inner tubes and acid-treated fabric scrap. In this process, the scrap is commonly ground to about pea size or finer, after which it is mixed with caustic, swelling agents or oils, as desired. This mixing is carried out in an open internal mixer, the scrap then being placed in containers such as open pans four to six inches deep. These pans are stacked on cars which are rolled into a cylindrical, horizontal heater into which live steam may be passed. The material is subjected to this live steam treatment at pressures from 100 to 175 pounds for varying periods of time. After the treatment is finished, the "biscuits" as they are called, are removed, dried, and are then ready for the mill room operations as described above.

THE MECHANICAL PROCESS:

A great deal of scrap is partially reclaimed by what may be called a "mechanical process", namely, grinding the scrap without previous heating. Many plants carry out this operation in order to utilize their overflow and defective production. The operations consist only in grinding, screening and cooling, the size of the ground particles being determined by the particular requirements. The product thus obtained is used as a filler. It has a low specific gravity, assists molding, and cuts down shrinkage.

In this brief outline of the methods of reclaiming and the operations involved, it must be emphasized that the procedure is not a simple one in any sense. These

STEPS IN THE PROCESS OF RECLAIMING RUBBER

FIGURE 4.

operations offer many chemical engineering problems, and many factors must be carefully controlled in order to obtain a uniform product. Great progress has been made in this direction by the reclaiming industry in the last ten years until it may be said in all fairness that reclaimed rubber as manufactured today is more uniform in quality than crude rubber.

Theory of Devulcanization

If vulcanization means the chemical combination of rubber and sulfur, then the word "devulcanization" as applied to the reclaiming of vulcanized scrap rubber is decidedly a misnomer, because sulfur is not separated from the rubber molecules in this process. It has been demonstrated *(1)* that during the so-called devulcanization process, sulfur actually combines with the rubber. However, during a pre-treatment in 8% caustic solution for 60 hours at 55 to 65°C. a portion of the free sulfur is removed and therefore cannot combine with the scrap during the subsequent high-temperature treatment.

Practically, the combination of rubber and sulfur has thus far proven an irreversible reaction. Numerous attempts have been made to separate the sulfur from rubber without success. D. Spence *(2)* obtained patents for treating vulcanized rubber with large quantities of mixtures of sodium and aniline under heat. The conditions of his experiments were so severe that the product was depolymerized. Recently some work was carried out in this laboratory in an effort to perform this experiment without destroying the rubber hydrocarbon. It was found that by milling sodium or a mixture of sodium and aniline into vulcanized scrap on the mill, no reaction was obtained.

The commercial reclaiming processes just described do not remove combined sulfur; they plasticize the scrap rubber by means of heat energy, mechanical energy, and the chemical action of softening agents. While the mechanics of devulcanization may be quite complex, it can readily be compared to the process commonly known as "reversion." This phenomenon is familiar to all rubber technologists. When soft rubber is vulcanized it reaches a cure at which the maximum physical properties are apparent. Upon further heating the material becomes less elastic and more plastic and may even become sticky if the heating is carried sufficiently far.

It has been recognized that the degree of devulcanization or depolymerization of the rubber molecules has a relationship to the amount of chloroform extract obtainable from the reclaimed rubber. Winkelmann *(3)* has shown that 43½% of the total rubber content of a specific tube reclaim was chloroform-soluble, and contained in this chloroform-soluble material was only 7% of the total combined sulfur. The chloroform extract could be revulcanized when mixed with 5% of sulfur and heated. After this treatment, it was only 2.3% soluble in chloroform.

Kirchhof *(4)* also ran experiments showing that approximately five times as much combined sulfur remains in the chloroform-insoluble portion as in the chloroform-soluble portion. Miller *(5)* has also carried out a series of experiments on re-reclaiming reclaim in which he carries a sample of reclaim through four cycles. The results of these tests are reproduced in Table 2.

In these experiments the rubber was gradually combining with more and more sulfur and approaching the hard rubber state. It is well recognized that hard rubber cannot be reclaimed by the usual methods.

TABLE 2

	Original Reclaim	*Reclaim after four cycles*
Rubber Content (by Diff.)..	60.0%	42.0%
Corrected Acetone Extract..	10.5%	21.7%
Total Sulfur	2.82%	8.56%
Free Sulfur	0.07%	0.51%
Combined Sulfur (by Diff.)	2.75%	8.05%
Chloroform Extract	22.0%	5.2%

Considerable work has been done showing that oxygen plays an important role in the mastication of crude rubber. We know that it plays an equally important role in the devulcanization of vulcanized rubber. For instance, a certain tire reclaim can be devulcanized thoroughly in 15 hours at 377°F. in a pan heater. If, however, the heater is blown down and the door opened after 4 hours and the charge re-cooked one more hour, or a total of 5 hours in all, this time is equivalent to the above mentioned 15 hours without opening the door.

Recently, oxygen bearers have been introduced for promoting oxidation during the devulcanization process in digesters. Under certain conditions they may have some benefit, but under some others, the benefit is questionable.

It is apparent from the work described above that during the drastic treatment given to scrap rubber in the devulcanization process it breaks down into two parts: the one soluble in chloroform and containing but little of the combined sulfur, the other insoluble in chloroform and containing the bulk of the combined sulfur. During the vulcanization of rubber we may assume that sulfur combines with only a portion of the rubber molecules, the rest of the molecules being polymerized or for some reason drawn together into aggregates during the reaction without having the sulfur combined with the rubber in any way. Then, during further heating, the aggregates which were free of sulfur are broken down and form the chloroform-soluble portion whereas the molecules combined with the sulfur resist the heat treatment and remain intact as the chloroform-insoluble portion.

Types of Reclaimed Rubber

Reclaimed rubber may be classified or identified in a simple manner by referring to (A) the type of scrap, and (B) the method of manufacture. Generally a combination of the type of scrap and the method of manufacture is used in designating reclaim. For instance, there are such names as alkali whole tire reclaim, acid tire reclaim, pan process tube reclaim, etc. Such names are self-explanatory. Further than this, classification is made by specific gravity and rubber content, cleanliness and color.

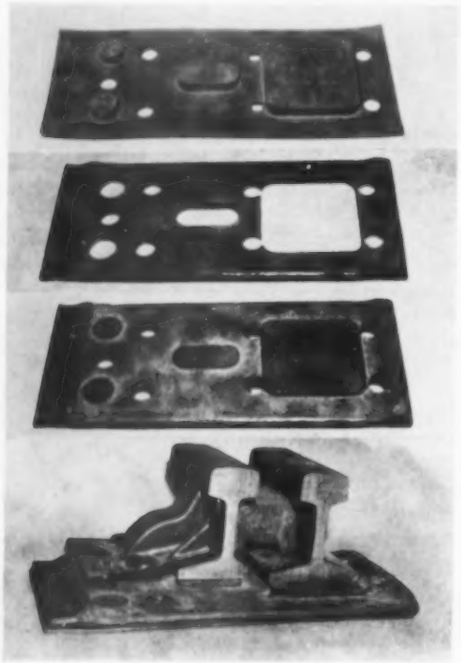
The specific gravity and rubber content are changed by a blending of scraps or by the use of compounding materials to impart certain desired properties. Some reclaims are developed for tubing work and are very clean, whereas for certain molding work, roughly refined and unstrained reclaim may be quite satisfactory and economical for the consumer. In considering tube reclaims, the color becomes a part of the designated name, for example red tube reclaim or gray tube reclaim. Such colors of course may cover a range of shades or intensities, necessitating identification by samples.

(To be continued)

(1) Shepard, Palmer and Miller, *Ind. Eng. Chem.*, **20**, 143 (1928).
(2) Spence, D., U.S.P. 1235850 (1917), 1235852 (1917).
(3) Winkelmann, *Ind. Eng. Chem.*, **18**, 1163, (1926).
(4) Kirchhof, *Kautschuk*, **11**, 115 (1935).
(5) Miller, *Ind. Eng. Chem.*, **20**, 1165 (1928).

Stedman Resilient Tie Plate

TESTS conducted to date on a new resilient combination tie plate indicate a series of advantages in the operation and maintenance of subways and elevated structures to a point where early wide-spread adoption seems imminent. The tie plates, invented by



Stedman Resilient Tie Plate

Top to bottom: the rubber shoe or cushion; metallic harness; shoe and harness assembled; complete assembly for guard rail with brace as used in subway rigid track construction.

T. W. Stedman, vice-president, Resilient Products Corporation, New York City, in cooperation with engineers of the Essex Rubber Company, Trenton, N. J., consist of composite rubber shoes harnessed by metallic jackets. The rubber shoe comprises four plies, each ply of varying tensile strength, so arranged that the bulk of the impact is received in the center of the shoe.

In operation, the rubber shoe is placed between the base of the rail and the tie so that the rail is at all times suspended on a rubber seat and has no direct contact with the tie. The jacket serves as a harness to hold the rubber cushion in place. Use of the resilient tie plate eliminates the former metal-to-metal contact between the rail base and the tie plate, with the result that the rail rests completely on a rubber cushion rather than on steel and wood or concrete. The metallic jacket, in addition to holding the cushion in position, also acts as a shoulder for the rail. Although these jackets are built to specification for new tie plates, it is also possible to fit the rubber shoes to existing equipment, according to Mr. Stedman.

Among advantages cited for this resilient combination tie plate are the following: in track maintenance economies are derived from the extra protection of rails, points and crossings due to cushioning effects in relation to absorption and distribution of wheel loads, as well as protection against abrasion to the faces of the ties; reduction to minimum power leakage and deterioration of track and equipment from electrolysis (where plates are installed on an electrified line) because of the insulation factor; absorption of impact due particularly to loose or hanging ties as a result of road bed inequalities; and practical elimination of vibration.

Additional advantages apply to operation, including greater comfort to passengers because of the direct action of resilient or cushioned track upon the rolling stock; reduction of the side sway of rolling stock, the structural design of the plate restraining the rails from tilting; and economies reflected in prolonged life of wheel treads, springs, bolsters and other numerous mechanical parts pertaining to locomotives and rolling stock.

In general, one of the major advantages of the Stedman resilient tie plate over all other types, according to its inventor, lies in the noise elimination by means of complete insulation of metal contact and impact generated from rolling stock to road bed. The noise elimination feature not only applies to the din which is most apparent in and around stations, but also to that which transcends from the road bed upward through the floors of the cars while in transit. The illustration (herewith) gives an excellent picture of the composition of the plate.

Selfvulc Insulator

A RUBBER COMPOUND, incorporating the quality of a primer with a self-curing, cold-curing rubber which can be applied by dipping, spraying or hand brushing, has been developed by the Self-Vulcanizing Rubber Company, Inc., Chicago, Illinois. Termed Selfvulc Insulator, the new compound is said to eliminate the necessity of using a separate primer before rubber coatings can be applied to metal or other surfaces to protect against corrosion.

Although the new compound makes a steadfast bond in one application, repeat coats to any desired thickness may be added. A vulcanizing period of one hour is all that is required for the first or following coats. The company states there is practically no shrinkage in application, the product being 90% rubber. It is said to give a smooth, enamel-like finish to any surface.

In addition to being both an insulator and a waterproof compound, Selfvulc Insulator also resists corrosion caused by alkalis, salt solutions, mild acids and their fumes, and is adaptable for covering girders, ducts, ventilators, hoods, pipes (both interior and exterior), tanks, vats, ceilings, bodies and frames of tank cars and structural steel.

Activation Effect of Zinc Oxide

ACCORDING to tests recently conducted by the R. R. Olin Laboratories, Akron, Ohio, it appears that when a standard slow curing zinc oxide is used with Monex or Thionex, acceleration of cure is constant with any percentage of zinc oxide between 1 and 10% on the rubber. It was found that with Captax, 808 and D.O.T.G., 1% of zinc oxide is most active, while 2.5, 5 and 10% are slower and about equal as regards rate of acceleration as evidenced by modulus at 600% elongation. This suggests milling 1% of zinc oxide into rubber while it is being masticated when it is desired to produce the fastest curing compounds possible with D.O.T.G., 808 or Captax, Such compounds, however, should be protected against possible reversion, according to the Olin Laboratories.

An index to Volumes 39 and 40 of THE RUBBER AGE will be found facing page 64 of this issue.

The Carbon Reinforcement of Rubber *

By W. B. Wiegand
Columbian Carbon Company

We turn now from surface energy to some other aspects of reinforcement theory.

Mechanical Reinforcement

THE SCHIPPEL EFFECT

Any discussion of the mechanical features of reinforcement must begin with consideration of whether or not rubber and pigment remain united or not. Schippel showed that the coarse, non-reinforcing pigments developed large volume increases in stretched rubber and later investigators confirmed microscopically his deductions as to the presence of vacuoles. Clearly where the rubber pulls away from the pigment particles the latter can play no positive role in reinforcement and can only detract from physical properties by virtue of dilution and also, depending on their crystal habits, by the cutting effect brought about during lateral contraction, thus hastening rupture.

Schippel's data confirm the permanence of the bond existing between rubber and such reinforcing pigments as carbon black, lampblack and zinc oxide. The absence of volume increase with exceedingly fine pigments may, however, be regarded as in some measure due to diminished stress *(9)*. It is also to be noted that iron oxide showed a volume increase practically as low as that for carbon black and that Schippel states that lampblack showed an even smaller volume increase than carbon black. The facts can perhaps be summarized in the statement that the absence of vacuole development or of volume increase is a necessary but not a sufficient condition of reinforcement.

SOLID FILM THEORY—Spear *(10)*

Postulating the adsorption of rubber on the surface of the carbon particles, Spear first points out that the portion of the rubber on the immediate surface of the carbon ought to have less extensibility than the original rubber, also that the total elongation of the mass would be less than if pure rubber only were present because a considerable portion of the distance is taken up by the particles of the compounding materials.

Spear then explains that: "According to the plastic solid film theory, the films between the solid particles of carbon black are much more resistant to distortion than the matrix would be were no compounding ingredient present. This explains at once why the mass is stiffer and why the curves for carbon black stocks partake very nearly of the nature of straight lines. Even for low elongations these films are thin enough to become operative, whereas in the case of pure gum stocks, the stretching process must proceed a considerable distance before the matrix is thinned sufficiently to form effective films. Finally, these films are very strong, hence we should expect the ultimate tensile of carbon black stocks to be high, which is, of course, in accordance with the facts."

Wiegand *(11)*, in discussing Spear's theory, alludes to its attractive features but draws attention to irregularities such as lithopone. To this might be added certain striking differences between pigments of similar particle size such, for example, as P-33 and Shawinigan, Fumonex or lampblack, all of which are in the same general range of particle size (between .1 and .2 μ but which differ basically in reinforcing behavior.

In all probability the Spear effect makes itself felt to some extent in all reinforcement phenomena, subject, however, to important differences depending upon surface activity and particle shape (v.i.).

Stress Distribution: Wiegand *(11)* has pointed out that provided anchorage between pigment and rubber is complete, there will be continuity of stress, the lines of stress going through each particle instead of around it. Also that uniformity in pigment particle size will result in a balanced state of stress throughout the rubber matrix, thus preventing any piece-meal type of failure which would tend to shorten the stress strain curve.

Shape of Particle: The effect of differing particle shapes has been discussed by various writers. A suggestive mechanical analogy has been described by Barnett *(9)* whose conclusions, which are all of course based on the assumption of complete anchorage, are as follows:

(1) Stresses are greater at the surface of large particles than smaller ones, thus explaining the Schippel effect.

(2) The stress in the vicinity of a rectangular particle is great if the particle is oriented with its length parallel to the direction of pull, but small if oriented normal to this direction.

(3) The addition of pigment causes the strain on considerable of the rubber to be raised to the stiff part of the stress strain curve, when the average rubber would normally be in the soft part of the curve.

Wiegand *(12)* cites the stiffening action obtained by means of 1/16-inch ground fibres and points out that a pure gum mixing containing fibre shows a stiff curve at the outset which later on collapses. Clearly, during the early part of the curve each fibre anchored or immobilized some of the rubber but was later unable to maintain the anchorage. He pointed out also that anisotropic ingredients such as talc and clay, plaster of Paris, etc., could be regarded as acting in a similar manner excepting that since the particles were of various sizes and lengths the sharp discontinuity in the fibre stress-strain curve would disappear. Instead there would be a stiffening effect throughout the curve.

He also suggested that some such condition might be the explanation of the inferior reinforcing properties of lampblack despite its marked stiffening action, and that, in general, particle shape might explain the behavior of these pigments which stiffen markedly and yet show low resistance to tear.

This brief review of the mechanical aspects of reinforcement has been included with no intention of attaching to them any enhanced importance. It would, however, seem salutory in the deeper consideration of true reinforcement to keep in mind the nature and

* Concluded from THE RUBBER AGE, February, 1937, pp. 358-362.

extent of those physical changes which may be ascribed to mechanical forces as distinguished from colloidal and molecular forces.

Need for a New General Reinforcement Theory: It has already been pointed out that surface tension forces, although widely invoked since 1920 by various investigators, have not provided any convincing picture of the modus operandi of reinforcement of rubber. So far as the writer is aware there is not the slightest evidence to indicate that, during the extension to rupture of properly reinforced rubber, progressive changes in the pigment-rubber interfacial boundary occur at all. In these circumstances it would seem idle to attempt to equate purely hypothetical changes in *free* surface energy with energy absorption values which are in a preponderating degree non-reversible.

Any new concept of the structure of reinforced rubber would be expected to shed at least some light on the outstanding features which still stand in need of explanation. Some of these will now be listed.

POINTS REQUIRING ELUCIDATION IN ANY NEW GENERAL THEORY OF REINFORCEMENT

(a) *General Trend of Reinforcement.*

Course and character of energy—Loading curve.

Early maximum occurring long before the calculated limits of pigmentation based on considerations of piling.

(b) *Detailed Feature of the Loading Curve.*

Regions A, B and C. Solubility of uncured reinforced mixings.

(c) *The Properties of Various Soft Carbons—Effect of Surface Chemistry.*

(d) *The Properties of Other Reinforcing Powders.*

OUTLINE OF NEW REINFORCEMENT THEORY

On the assumption of a continuous phase of rubber the tetrahedral piling of the pigment phase would result in the theoretical possibility of loading 300 volumes of pigment to 100 volumes of rubber, or in the case of carbon black approximately 600% by weight on the rubber. Such proportions have never been even remotely approximated. Calculations also show that in a 50% tread stock the inter-particle distance would equal one radius or 25-30 mμ which is one-fifth the estimated minimum diameter of the masticated rubber macro-molecule. These facts illustrate the need for revision of existing theories.

We therefore begin by:

(1) The replacement of the existing assumption of a system composed of a reinforcing pigment constituting the dispersed or discrete phase immersed in a continuous phase of rubber, by the view that the rubber phase is also discrete and consists of structural units (macro-molecules) larger in general than the individual particles of reinforcing carbon.

(2) The association of reinforcing particles with the rubber macro-molecules in what may loosely be termed a new molecular complex possessing altered chemical and physical properties as compared with pure rubber.

(3) In respect of carbon black reinforcement the attachment of single layers of carbon particles around each rubber macro-molecule, these particles also functioning as bonds between adjacent macro-molecules.

(4) The possibility of the disposition or packing of a limited additional proportion of carbon particles in the "voids"* between the rubber units.

(5) The "voids" having been filled, the incorporation of additional quantities of carbon black will entail gradual wedging apart of the rubber units with progressively diminishing reinforcement.

APPLICATION OF NEW THEORY

(a) *General Trend of Carbon Reinforcement.*

In Table I there is illustrated the application of the theory to a tire tread reinforced with carbon black. The calculated position of the maximum appears to fit in well with the empirical optimum loading (50 to 55% on the rubber).

(b) *Regions A, B and C of the Energy-Volume Loading Curve.*

Region A: In the case of reinforcing carbons we picture the attachment of a single layer of carbon particles around each rubber macro-molecule as presenting no free carbon particles. The new molecular complex of carbon and rubber is being built up in direct proportion to the addition of carbon black, thus accounting for the rapid and approximately linear rise in energy with volume loading in this region.

The bound condition of the carbon explains the excellent electrical resistivity and break-down properties in Region A. The absence of friction between free carbon particles accounts for the relatively high rebound resiliency and "liveliness" of compounds containing 12% or less by volume of carbon black.

Region B: As we pass into this region through the incorporation of additional carbon black the first stage is complete saturation as regards the mono-particle layer, accompanied by the increasing presence of carbon which is not bound or chemically combined with the rubber and which tends to fill the voids or interstitial spaces. The presence of this "free" black causes an immediate and sharp drop in the electrical resistance properties and adversely affects rebound resilience while at the same time the rate of increase of energy absorption or "proof resilience" declines.

At the point where sufficient carbon has been added to fill the interstitial spaces but no more, we have reached, at least approximately, the maximum of the energy curve. The reason for this maximum is the co-existence of maximum bond or attraction between the rubber units which are cemented together with a monolayer of carbon, and the frictional resistance of the free carbon particles present in the interstitial spaces, which of course adds to the (non-reversible) absorption of energy.

We thus account for the co-existence in carbon reinforced rubber of high hysteresis, low rebound resilience, relatively high durometer hardness, and at the same time maximum wear and tear resistance.

Indeed, far from considering the low rebound and high hysteresis of carbon reinforced treads at the optimum portion of Region B as an unmitigated evil, the writer ventures the opinion that, at least in pneumatic tire treads, the low rebound resilience, or relatively high capacity to degrade energy into heat, may actually improve road wear. Whereas in the case of a perfectly resilient tread the rear section of a non-skid button would be subject to the law of action and reaction, what actually occurs in the case of a carbon black tread is that the "kick-back" as the button leaves the road is reduced in intensity by approximately 40%, thus reducing "wiping" and cupping.

Also in Region B the attainment of complete en-

* These voids are not pictured as pre-existent but as developable during the progressive incorporation of reinforcing pigments such as carbon black. The rubber macro-molecules are assumed to be deformable.

The three charts on this page appeared with the first installment of Dr. Wiegand's paper in the last issue of THE RUBBER AGE and are reproduced here so that they may be readily available for reference purposes in connection with this concluding installment of the article.—Editor.

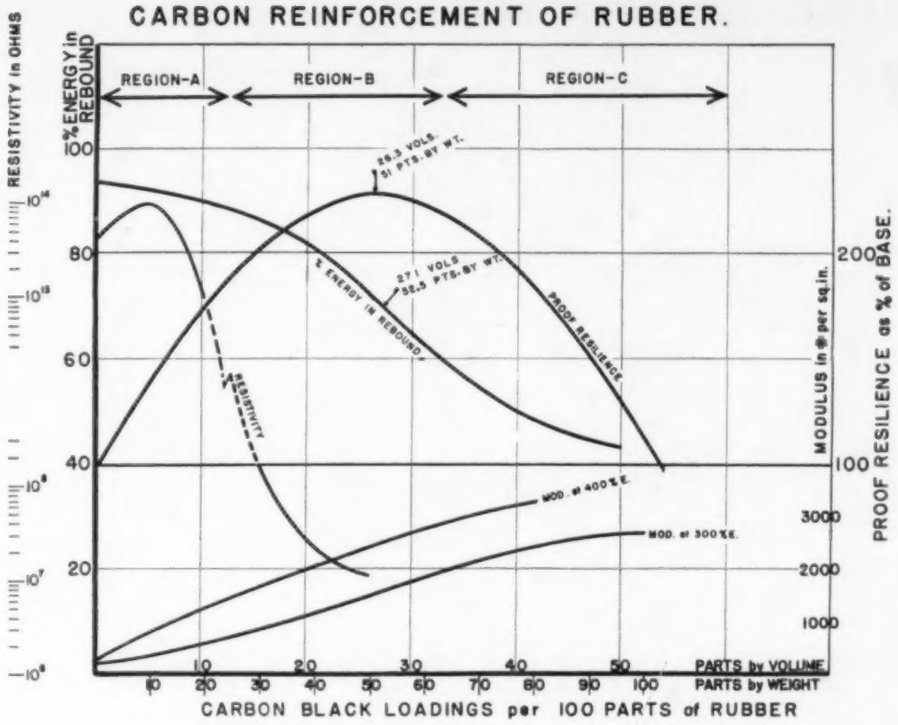


FIGURE 1—Carbon Reinforcement of Rubber.

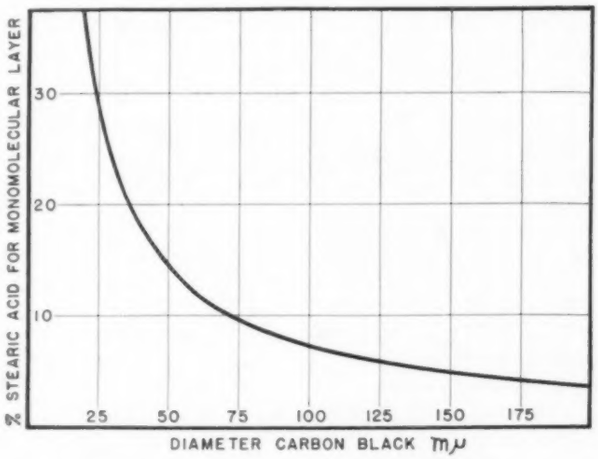


FIGURE 2—Relation Between Diameter of Carbon Black Particle and Percentage by Weight of Stearic Acid Required to Form a Monomolecular Layer.

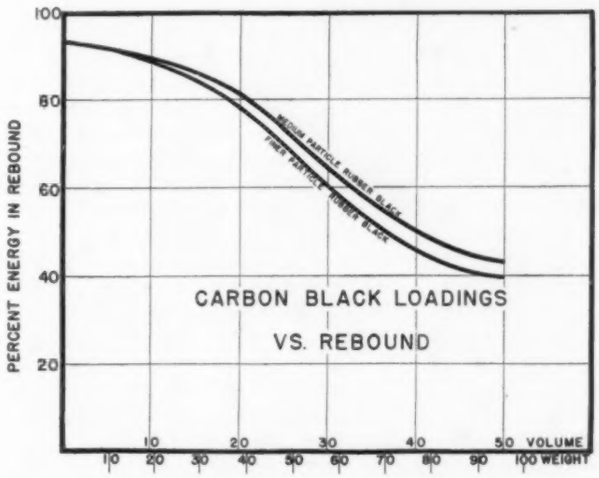


FIGURE 3—Carbon Black Loadings vs. Rebound.

casement of the rubber units in a layer of chemically bound carbon black would be expected to cause a sharp decrease in the solubility of the unvulcanized mix.

Region C: The addition of carbon black in amount greater than that required to fill the voids (approximately 25 volumes) results in wedging apart to an increasing degree the structural units of rubber with their surrounding envelopes of carbon particles. From this point on, the increase in frictional resistance is no longer sufficient to offset the decreasing cohesive strength, and reinforcement progressively declines.

The extraordinary range of Region C in the case of carbon black, characterized by comparatively high values for tensile strength and elongation, at loadings which have already produced a hardness and plasticity of leather-like character, may be understood in terms of the close packing possible in the case of an exceedingly fine pigment of this kind, thus minimizing the separation of the rubber structural units. Conditions of uniform stress would manifestly be impossible in the case of heavy over-loading with pigments consisting of irregularly shaped particles *larger* than the rubber macro-molecules themselves.

(c) *The Properties of Various Carbons—Surface Chemistry.*

In so far as reinforcement is concerned it would appear that the presence of a certain as yet undefined minimum of combined oxygen on the surface is essential to intimate bonding with the rubber. Carbon pigments may therefore be divided into those with active and those with inactive surfaces.

The lampblacks, including natural gas varieties of this general type, such as Fumonex and Gastex, are

TABLE I

NEW REINFORCEMENT THEORY

(1) ASSUME: RUBBER THE DISCRETE PHASE—SPHERICAL HABIT—TETRAHEDRAL PILING—RUBBER = 74 VOLUMES—VOIDS = 26 VOLUMES

	Volumes	Parts by Wt.	R = 100 (Wt.)
Rubber } 74 Vols.	73	67.9	100
Sulphur (3%) } 74 Vols.	1		3
Zinc Oxide } 1% Soluble	0.15		
Zinc Oxide } 4% Pigment	0.5	2.8	5
Carbon Black (No Fines) 74% of 25.5 Vols.	18.87	33.96	50.01
Stearic Acid (Fixed @ 4%)	2.9	2.72	4.0
Accelerator (1% Mercapto)	0.5	.679	1
Antioxidant	0.6	.679	1
Pine Tar (Balance)	2.35	2.54	3.75
	99.87		167.76

(2) ASSUME FURTHER: ZINC OXIDE—3% (1 SOLUBLE, 2 PIGMENT)—25% OF CARBON BLACK VOIDS FILLED WITH ITS OWN FINES

	Volumes	R = 100 (Wt.)
Rubber } 74 Vols.	73	100
Sulphur (3%) } 74 Vols.	1	3
Zinc Oxide (1% Soluble, 2% Pigment)	0.36	3
Carbon Black	20.93	55.6
Accelerator	0.48	1
Antioxidant	0.57	1
Stearic Acid (Fixed @ 4%)	2.88	4 } 5.24
Pine Tar (Balance)	0.78	1.24 }
Total	100.00	168.84

N. B.—Softener to Black Ratio Now 9.5%.

intermediate in regard to surface activity between the impingement carbons and the thermal decomposition carbons. They are also larger in particle size and probably of elongated habits. They would therefore be expected to have a shorter reinforcing range because of their being too large to pack within the interstitial voids. They will show high modulus partly because of particle shape (mechanical reinforcement) and partly because of surface activity (chemical reinforcement). The presence of a considerable proportion of particles larger than the rubber macro-molecules will clearly shorten the stress-strain curve and diminish tear, but provide improved rebound resilience and less hysteresis because of diminished inter-particle friction.

Finely divided thermal carbons, such as P-33, having an inactive surface and a high degree of uniformity, will be expected to pack well, to show a wide range of loading capacity, will show no tendency to form a new molecular complex, and so will leave the stress-strain curve substantially unaltered. There being a minimum of interference with the rubber structural units, the elongation is excellent, also tear resistance. Mechanical reinforcement through the development at high elongations of plastic solid films may also play some role as regards tensile strength.

If, with no other change, the surface of such a black could be rendered active through the presence of oxygen compounds, one would expect a rise in modulus and a decrease in elongation. That such indeed happens is indicated by Spear *(13)*.

Inert carbons of particle size larger than that of the macro-molecule of rubber would be expected to pack relatively poorly, to separate the rubber units, to contribute to cutting action at the stage of intense lateral compression, and so to bring about shortening of the stress-strain curve. These carbons are illustrated by Thermax and Velvetex. Compounds made from such carbons are, of course, highly resilient.

It may here be pointed out that according to this theory there must be certain compensations among reinforcing pigments. A maximum of tensile strength, for example, cannot be expected to coincide with maximum rebound resilience. Conversely, reinforcing pigments which are too large in particle size to pack interstitially and which are therefore wedged between the rubber structural units will always tend to show low hysteresis effects. They are literally "mounted in rubber".

Also, on this theory, relatively high hysteresis and low rebound emerge as inherent or structural concomitants of perfect reinforcement, at least as defined in terms of energy adsorption and wear resistance.

(d) *Other Reinforcing Powders.*

The explanations already given in respect of different shapes and sizes of carbon particles would seem capable of application to other compounding ingredients. The two cardinal considerations according to this theory are: (1) The activity of the surface vis à vis the rubber substance which evaluates their capacity for true or molecular reinforcement, and (2) the size and shape of the particles, which influence their packing and distribution amongst the macro-molecules of rubber.

In proportion as they are lodged, not interstitially but between the rubber structural units, they diminish resistance to wear and tear, improve the rebound resiliency, but shorten the effective (reinforcing) loading range.

Conclusions

The theory here roughly sketched can in no sense claim completeness. It may, indeed, be found incompatable with many facts. Some of the points requiring further analysis and study are:

(1) The effect of continued mastication, with diminishing molecular weight, upon the course of reinforcement, with particular reference to particle size and to the position of the energy maximum.

(2) The effect of elongated shape of the rubber macro-molecules upon the voids calculations.

(3) The effect of the mono-particle layer assumption upon the voids calculations.

(4) The location of various softeners and non-pigment ingredients as between the rubber phase and the pigment-in-voids phase.

(5) The theoretical analysis of tear phenomena in relation to the "Discrete-Rubber" theory.

The writer's reason for propounding the "Discrete-Rubber" theory of rubber reinforcement at this time is that for upwards of a year he has found it a more convenient way of viewing the known facts, and that it has already to some extent been found useful in fields other than rubber, where high molecular weight vehicles are combined with colloidal carbon. He therefore hopes that where it may not solve, it yet may stimulate!

LITERATURE CITED

(1) Barron and Cotton, *I. R. I.*, **7**, 209 (1931).
(2) Wiegand, *I. R. W.*, Oct. 1, 1920, page 18.
(3) Parkinson, *I. R. I.*, **5**, 263 (1929).
(4) Cotton, *Ibid.*, **6**, 248 (1930).
(5) Lefcaditis, *Ibid.*, **9**, 67 (1933).
(6) Hauser, "Handbuch der gesamten Kautschuktechnologie," **1**, 218.
(7) Hock, *Rub. Chem. & Tech.*, **7**, 462 (1934).
(8) Winkelman & Croakman, *J. I. E. C.*, **20**, 134 (1928).
(9) Barnett, *Physics*, **7**, May, 1936.
(10) Spear, "Colloid Symposium Monograph" (1923), **1**, 321.
(11) Wiegand, *I. R. I.*, **1**, 141 (1925).
(12) Wiegand, *Can. Chem. & Met.*, November, 1926.
(13) Spear and Moore, U. S. Patent 1,794,558.

PUBLIC LIBRARY
DETROIT, MICH.

Twenty Years of Progress

Last month, in connection with the celebration of the 20th anniversary of THE RUBBER AGE, we presented a number of reviews or digests covering the developments which have taken place in the various branches of the rubber industry during the past two decades, written by leading authorities in their respective fields. Because of the number of reviews, it was not possible to publish them all in our preceding issue. Therefore, we are presenting herewith a number of additional reviews of developments in the last twenty years, and in our next issue we will complete the series. We are indebted to the authors of this interesting series of reviews for their cooperation in enabling THE RUBBER AGE to present a panoramic view of the rubber industry's progress since 1917.

Twenty Years of Crude Rubber

By E. G. Holt

Assistant Chief, Leather and Rubber Division,
Bureau of Foreign and Domestic Commerce

THE RUBBER AGE was born with the entry of the United States into the World War, and in the two decades that have passed, rubber history has been largely dominated by the history of the maturing plantation rubber industry. In all previous decades back to the discovery of vulcanization nearly 100 years ago, rubber production had been the result of destructive exploitation of forest rubber reserves, sometimes at the expense of horrible human mortality in the areas of production. But if those reserves had not been exploited, they would now be worthless.

In 1917 world production of plantation rubber amounted to 221,000 long tons (Malaya, 135,000; Ceylon, 32,000; Netherlands Indies, 45,000; British Borneo, 4,000; India and Burma, 4,000; and Indo-China, 1,000 tons). The industry was still in comparative infancy, and production was almost wholly in the hands of estates organized as companies; although planting by natives had begun, no hint of its future importance to the rubber world then existed. Bud-grafting and seed selection were then barely initiated as experiments; cultivation and tapping methods were still in the process of evolution.

Expectation of greatly increased yields resulting from earlier heavy planting was just beginning to cause apprehension among thoughtful producing interests, but prices were still high. At the time nobody had the courage and foresight to believe that within two decades the world would require over a million tons of rubber annually, and that cheap rubber would call for even larger quantities.

The depression of 1920-21 was the fulcrum on which the Stevenson Rubber Restriction Scheme was placed in effect. In the long history which the industry has before it, that scheme seems destined to eventually appear merely as an incident. The rubber industry in every decade from 1849 to 1909 had with great regularity doubled its value of products; in 1919 and 1929 the rate of progress though irregular was far more than maintained, but fears of the immediate future overbalanced long range considerations of the destiny of the commodity, and introduced the additional uncertainties of attempted human control.

That scheme, applying only to British plantations, and permitting continued planting, proved incapable of long-term success and was abandoned, but during its course it led to a tremendous increase in current and prospective rubber production in the Middle East, laid the ground work for plantation rubber in Liberia, the Philippines and Brazil, and revived the search for synthetic rubber.

The depression of 1930-1934 was of a duration that demonstrated the possibilities of low cost production for natural rubber, but temporary fears of low profits again outweighed faith in the future of the industry, and the result is expressed in the International Rubber Regulation Agreement, applying to areas which produce fully 97% of the world's rubber, and limiting new planting as well as current production in these areas. Obviously, such a control can remain effective for many years, but the lessons of cheap rubber, and the possibilities for large scale development of production by natives which the past has driven home, indicate that even a plan of this inclusiveness needs to be temperate if it is to enjoy longevity. Perhaps decades will be required to demonstrate its effectiveness and its direction of influence on the rubber world.

It has been given to a few prophets, from time to time, to visualize and express themselves upon the future tremendous possibilities for application of this commodity, rivalled by no others in its range of utility. Up to the present time, no one of them has overstated the case. From a long range viewpoint the rate of growth seems more likely to be maintained in the near future, than to show a leveling-off as compared to the past; there appears to be no prospect that the world can get along with lower quantities of rubber, synthetic or natural, than at present.

Tires and Tubes in the Past Twenty Years

By R. P. Dinsmore

Assistant to Factory Manager, Goodyear Tire & Rubber Co.

THE past twenty years cover approximately half of the present life history of the automobile tire in this country. Its developments, which have been so continuous as to excite little comment, are startling when viewed over the period of two decades.

During this time the cord tire came into its own and completely displaced the square-woven fabric tire. Originally designed to economize power for the electric automobile, the cord tire stayed to serve the more hardy gasoline vehicle. From high-pressure tires with small cross-section and large wheel diameter and a cushioning effect measured by a deflection of 11%, the cord tire progressed through the balloon development with larger section and a deflection of 15% to the most recent low-pressure balloon with a still larger section and a deflection of 18%.

In the meantime wheel diameters have dropped from the neighborhood of 25 inches to a low of 15 inches. In this period also the clincher tire gave way to the straight side tire and various forms of clincher and straight side rims were finally displaced by the drop-center type. The commercial truck tire emerged from the status of a fantastic dream to complete domination of the truck tire field with the practical exclusion of its precursor, the solid tire. Like the passenger tire, the truck tire advanced to shapes giving greater cushioning, as typified by the modern bus balloon.

Other uses for tires developed. The airplane needed real cushioning and found it in the low-pressure tire. Farm vehicles were found to serve wider fields when placed on pneumatic tires. In fact a wide variety of industrial vehicles profit from the automobile-tire development.

The modern automobile tire, running under conditions not imagined by the manufacturer of twenty years ago, gives four to ten times the mileage. Balanced designs, improved fabrics, carbon-black treads, organic accelerators and antioxidants have all contributed to this desirable situation.

The cost of manufacture has been driven down by ingenious mechanical devices and by such process changes as airbag cure replacing core-cure, unit vulcanizers, flat-building of tire carcasses and improved mixing machines. Carbon black and organic accelerators had their effect on cost as well as on quality.

Inner tubes have had a less spectacular but equally important history. The old inner tube was vulcanized either with antimony, sulphur or sulphur and litharge. Organic accelerators changed the cost and durability of tubes in a revolutionary manner. Compounding with special fillers and antioxidants produced the highly essential heat-resisting truck and bus tube.

In the period we are discussing the old calendered tube with the acid splice yielded first to the curved-mandrel tube with the steam splice, which was in turn succeeded by the full-circle tube. The curing went through the stages of wrap-cure in open steam, hot-water cure, and unit-mold cure.

Some of the old features of the tire business are changing. The outside tire protector has gone the way of the reliner. The puncture-proof tire has given place to the puncture-seal tube, and more recently, the blow-out proof tube. Quick detachable tires and double-cured tires have disappeared with square-woven fabric tires and only a few clinchers are still running. Times change, but in this instance, the car owner has no cause to be other than thankful.

Vulcanized Latex

By H. J. Elwell

Vultex Chemical Company

THE last twenty years have seen more strides in the use of rubber and the methods of processing than in all the previous eighty years following Goodyear's discovery of vulcanization. New methods of compounding have not only immensely improved the quality of the ordinary rubber products, but have made practical many new uses for this versatile material.

Twenty years ago latex was little more than of scientific interest—a laboratory curiosity. To be sure, a few had experimented with it, and there was a limited amount of literature about its characteristics and possibilities, but prior to 1920 latex was not commercialized to any extent. Not to be discouraged by previous failures, a limited group of rubber technicians continued to work upon this complex, unstable material and ultimately succeeded in developing processes for the manufacture of rubber goods direct from latex.

Among this group of latex pioneers was Dr. Philip Schidrowitz, the eminent British chemist. When in 1921 he published the results of his work on vulcanizing the rubber particles in latex without coagulation his disclosures met with considerable scepticism. That latex upon vulcanization did not jell like solutions or cement was remarkable, but what seemed even more incredible was that after vulcanization the particles would cohere upon drying. Many hastened to check Dr. Schidrowitz's results, and skepticism gave way to acclaim.

In the early days of vulcanized latex it required appreciable research on the part of the suppliers to develop not only compounds which would produce the desired physical characteristics but also suitable methods of application. This was essentially necessary because of the specialized field, practically barren of knowledge. Even after that it was frequently necessary to overcome the prejudices of the old school of milled rubber technicians for a material which violated so many of the accepted principles of the old art.

The depression added problems. Many prospective customers were loath to make expenditures for new equipment and processes, or leave the beaten path with business prospects so uncertain. In the face of such obstacles the record of steady progress in the form of uninterrupted and substantial increase in the use of vulcanized latex from year to year is evidence of the value of the process.

Many hundreds of specialized compounds, each for a particular and frequently a unique purpose, have

been developed in the United States alone. These involve the use of all three methods of vulcanizing latex discovered by Dr. Schidrowitz, viz: heating under pressure, heating at atmospheric pressure, and by compounding and storing at room temperature. Users of vulcanized latex include manufacturers of practically all types of dipped goods, such as: balloons, ink-sacks, dress shields, baby pants, prophylactics, household gloves, rubber coated cotton work gloves, novelties, bladders, nipples, bathing caps, surgeons' gloves and finger cots.

Other uses include the manufacture of pile fabrics, shower curtains, raincoat fabrics, corset fabrics, electric cables, can sealing, gaskets, rubber thread, tubing, substitutes for leather made either on a paper or fabric base, protective coating for metals, rug underlays, rug backings, golf ball covers, dry and wet bond adhesives for paper, leather, fabric, metal and wood, padding and book binding adhesives, molded goods (such as mannequins and novelties), rubber molds, coated kitchen utensils, surgical bandage, etc. There are also uses of a distinctly humanitarian interest.

As users of latex have recognized, this natural raw material is not only unstable but it is also a variable. Undoubtedly, this accounts to some extent for the favorable reception given by customers to a standardized, dependable compound and for the steady and rapid growth of the business, the percentage increase in sales from year to year being in excess of the growth of the use of latex. Other features are the elimination of the need for solvents with the accompanying fire hazard and risk of toxicity, greater strength and better aging. Standardization and predetermined quality make vulcanized latex the simplest form of rubber to use.

While the past twenty years have brought both problems and progress, they are but stepping stones for the future.

Development of Synthetic Rubber

By Ira Williams

Jackson Laboratory, E. I. du Pont de Nemours & Co., Inc.

SYNTHETIC rubber (rubber-like polymers of conjugated dienes) dates back to G. Bouchardt, who in 1879 found that isoprene would polymerize to a product having the characteristics of rubber. The possible commercial significance of this discovery was noted by Tilden in 1889 who showed that isoprene could be obtained from turpentine. Kondakoff in 1901 reported that 2-3-dimethyl butadiene 1-3 would polymerize spontaneously to a rubber. In the same year, Thiele found that piperylene would polymerize to give a poor quality rubber.

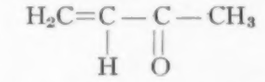
Previous to the war much effort was directed toward the production of dienes suitable for polymerization to rubber. Calcium carbide, coal tar, petroleum and starch were considered as raw materials. Fernbach and Strange developed a method for producing both amyl alcohol and acetone by the fermentation of starch. Amyl alcohol was converted into isoprene while acetone was readily converted into 2-3-dimethyl butadiene 1-3. Phenol derived from coal tar was converted into butadiene (erythrene) by a process of hydrogenation, dehydration and thermal cracking. A similar method converted benzene into butadiene but the yields were poor. Ostromislenski investigated a number of cracking processes for preparing butadiene. He also described a method for its preparation from alcohol and acetaldehyde both of which may be prepared from acetylene.

Several methods of polymerization were in use. Isoprene and dimethyl butadiene were known to polymerize spontaneously during the course of a year. Hoffman and Contelle in 1919 patented the process of polymerizing at an elevated temperature, and Harries used acetic acid in conjunction with heat. Mathews and Harries independently discovered the accelerating effect of metallic sodium and Holt found that a different polymer was obtained when a sodium catalyst was employed in an atmosphere of carbon dioxide. Various oxidizing agents, colloidal metals and ferments were also known to assist polymerization.

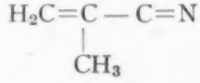
During the war synthetic rubber was obtained in Germany from dimethyl butadiene which was prepared from calcium carbide. According to Gottlob, the best grade of rubber was produced by sodium polymerization in an atmosphere of carbon dioxide. About 2,350 tons of methyl rubber were prepared by all methods during the war. The rubbers were greatly lacking in plasticity and the vulcanized product was of poor quality for most uses.

The investigation of synthetic rubber was stimulated a few years after the war by economic and political conditions in Russia and Germany and by the increasing price of natural rubber. More stress was placed at this time on methods of polymerization since it was realized that the quality could be influenced by the conditions under which rubber was formed. Most of the work was confined to butadiene. At present, a number of plants are producing butadiene rubber in Germany and Russia and production is being considered in other countries.

Mixtures of polymerizable materials are now used by I. G. Farbenindustrie for the production of artificial rubber. Unsaturated ketones of the type



are said to cross polymerize with butadienes. Nitriles of the type



and styrene are actually being used to polymerize with butadiene in Germany.

While the butadiene rubbers have been greatly improved they are not yet satisfactory. A study of the conditions of polymerization, modifying agents, the effect of impurities and the use of inert diluents, has produced a more uniform and more plastic product. Polymerization of emulsified butadienes has increased the speed of the reaction. The workability is, however, not satisfactory even when the rubber is compounded with very large amounts of softeners. The tensile properties and workability are much improved by the incorporation of carbon black. The butadiene rubbers are more resistant than natural rubber to the action of solvents.

A non-hydrocarbon rubber produced from 2-

chloro-1-3-butadiene was produced by E. I du Pont de Nemours & Company in 1931. This product, which is marketed under the name of neoprene, more nearly approaches natural rubber than any other synthetic rubber yet produced. The tensile strength and elongation compare with those of natural rubber. Neoprene gives an X-ray diffraction pattern when stretched and exhibits the Joule effect in a manner similar to natural rubber. The resistance to solvents and ozone is much greater than that of natural rubber.

The discovery of neoprene constitutes a distinct forward step in the production of synthetic rubber not only because of its improved quality but because the raw materials are readily available and because a satisfactory plastic product can be obtained. Acetylene is polymerized to vinyl acetylene and treated with hydrogen chloride to form 2-chloro-1-3-butadiene which polymerizes rapidly to form a plastic polymer. If the polymer is isolated while still plastic it can be stabilized in this condition for a number of years by incorporating such materials as phenyl b-naphthylamine. Vulcanization may be accomplished by heat alone but is improved by the presence of zinc oxide and acidic resins.

The use of synthetic rubber to meet conditions for which natural rubber is not suited is increasing rapidly. The production in the United States at present is in excess of 150,000 pounds per month. A considerable amount is also produced in Russia under the name of Sovprene and production is being investigated in both Germany and Japan.

Caoutchoids have recently become of increasing importance. Ethylene chloride will react with sodium polysulfide to form a high molecular weight rubber-like substance. This product is a plastic which can be vulcanized under the influence of heat and zinc oxide or oxidizing agents. The vulcanized product has excellent solvent resistance but has a narrower useful temperature range than rubber. Many varieties of this type of product can be produced by the use of different alkyl halides. Many unsaturated materials other than dienes will polymerize to substances having some rubber-like properties.

Much future improvement can be expected in the art of producing artificial rubber and caoutchoidal materials. Research will probably not be directed entirely toward the duplication of natural rubber. The greatest opportunity lies in the production of synthetic rubbers having special properties which make them superior to natural rubber. Such products if sufficiently low in cost could also compete with natural rubber in most types of service.

The Rubber Chemist

By Harry L. Fisher

U. S. Industrial Alcohol Company

(Formerly with the Development Department of U. S. Rubber Products, Inc.)

A GLANCE at a record of events of the history of rubber chemistry and technology shows that, outside of the discovery of vulcanization almost one hundred years ago, practically all of the outstanding technological achievements in the rubber industry have been made within the last thirty-five years.

In 1902 C. O. Weber published his chemical theory of vulcanization; two years later Harries described the ozonolysis of the rubber hydrocarbon and thus laid the foundation for an understanding of its structure; and two years after that George Oenslager discovered organic accelerators. Thereafter, an important discovery or invention was made in almost every year up to the present time.

Included among these accomplishments are important advances in organic accelerators—the thiuram-disulfides, the aldehyde-amines, diphenylguanidine, mercaptobenzothiazole; the use of non-accelerating antioxidants which together with accelerators meant so much in the extension of the application of rubber into engineering fields; the discovery of non-sulfur and organic vulcanizing agents; the attachment of rubber to metal; the preparation of concentrated latex; the electro-deposition of rubber from latex; the processes of making aqueous dispersions of dry rubber; the use of many new compounding ingredients such as carbon black, softeners, stable organic dyes, etc.; the development of accelerated tests for the life and for many practical uses of rubber; the use of rubber derivatives in molding materials, paints, lacquers and adhesives, and as thin transparent packaging sheets;—all these are important milestones of progress, of which the rubber chemist may well be proud.

Thirty years ago each automobile used an average of five tires annually and the mileage was not very great. Nowadays only one and one-third tires are required for each car and the mileage obtained is ever so much greater than that of their predecessors. Almost 80% of all the rubber produced goes into tires and tubes. Therefore, the rubber chemist has much to his credit in this great achievement.

The manufacture of rubber goods from latex has made a fine name for itself. Though the actual proportion of rubber so used is comparatively small, it is growing steadily. Latex is being used not only in ordinary fields of fabrication where it is doing some things far better than by the older processes, but it is also taking rubber into industries where no one apparently ever suspected it would be used. New discoveries will constantly be made and some of them will doubtless be of as much importance as those with dry rubber.

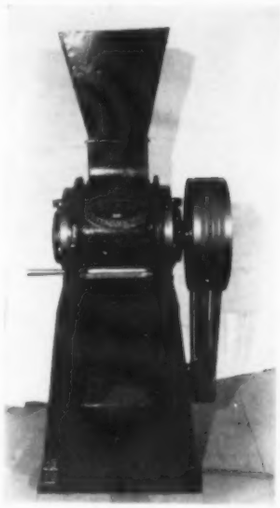
Rubber is unique and has served humanity in a multitude of ways: in the sick-room, in sports, in advertising, in chemical engineering and in transportation. The development of rubber compounds for surgeons' and electricians' gloves, electrical parts, hospital services, shock absorbers in automobiles and railroad trains, tires, clothing, hose, jar rings, toys, belting, aprons, airplane de-icers, is a fascinating story. The rubber chemist acknowledges his help in this great work from physicists and engineers.

What of the future? There are always new problems with us, and new applications of both old and new methods are the regular requirements of the day. Civilization marches onward and the rubber chemist will continue to have his important part to do. Not only will his work be with natural rubber but, as already is the case, also with synthetic rubber and rubber-like materials. Neoprene, Thiokol, Koroseal and Buna are names to conjure with. New materials, new processes, new ideas will challenge him and he will find happiness in being of service to his own and future generations.

New Equipment

Span Scrap Cutter

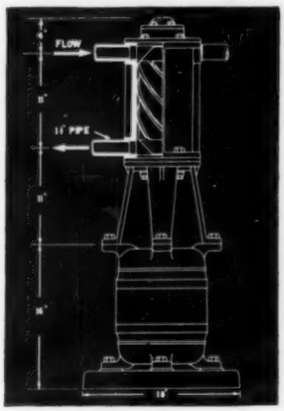
ESPECIALLY designed for the reduction of all grades of soft and hard rubber scrap to uniform small size, the Span Cutting Machine has been introduced by M. Pancorbo, 155 John Street, New York City. In addition to ordinary factory waste, such as overflow, trimmings and seconds, the machine also takes whole inner tubes, tire peelings, sections of old



tires, etc. Three revolving and three stationary knives are set at a suitable angle for best cutting effect, the knives being easily removed for sharpening purposes. The rotor runs at 750 r.p.m. As the material comes out of the cutter it passes through a ½-inch screen, ready to be fed to a grinding mill for grinding to fine powder form. It has a capacity of from 750 to 1,000 pounds per hour on soft rubber and 1,200 to 1,500 on hard rubber scrap, and requires 10 h.p. The motor is installed under the base of the machine. A suitable hopper or chute may be attached for loading quantities at a time, the machine feeding automatically by gravitation. It weighs 1,100 pounds without the motor. Although primarily designed for soft and hard rubber scrap, the new cutting machine is also suitable for many other materials. Special screens with larger or smaller openings may be used as required. M. Pancorbo also manufactures the Span Grinding Mill.

Bennett Dispersion Machine

ENGINEERED to improve upon various types of emulsifying equipment, a new type of dispersion machine (Model D), built on a new principle, has been introduced by Bennett, Incorporated, Cambridge, Massachusetts. Adaptable for latex dispersions, the new machine utilizes the liquid shearing power obtained by high speed rotation of blades parallel to a smooth surface combined with the action of centrifugal force, this principle giving it a capacity of up to 1,000 gallons per hour with a small 5 h.p. motor. According to Bennett engineers, the ordinary type of homogenizer, utilizing narrow orifices, has a capacity of only approximately 50 gallons per hour with a 5 h.p. motor. In operation, the materials to be emulsified are preferably blended together first in a tank equipped with an agitator; then this coarse dispersion is fed into the new dispersion machine. The processed material coming from the machine can be de-



livered against a liquid head, permitting direct discharge into storage tanks above the level of the machine. An extra inlet is provided so that two or more ingredients can be flowed in separately if desired. In this manner, by connecting the machine with suitable proportioning pumps, it can be used for continuous emulsification processes.

Mathews Heavy Duty Rollers

TWO new ball-bearing roller designs, both suitable for heavy duty service, have been added to the line of roller conveyors featured by the Mathews Conveyor Company, Ellwood City, Penna. Both designs incorporate self-contained double seals which protect the ball bearings and ball race-ways from foreign matter, such as dust, dirt and grit. The inner ball raceway is prevented from rotating on the axle, which is held stationary in the conveyor frame, by the use of hexagon axles on both new types. Seamless steel tubing is used.

Correction

IN describing the porcelain-lined Sta-Warm Electric Heater, manufactured by the Sta-Warm Electric Company, Ravenna, Ohio, which was developed in conjunction with the engineering department of the B. F. Goodrich Company, in our February, 1937, issue, we stated that "complete operation entails preheating by steam in other equipment to 300° F. after which the material is placed in the Sta-Warm heater and is carried up to 525° F." The company has called to our attention the fact that since the heater described was one for special use in connection with the Koroseal compounds developed by Goodrich this statement is erroneous, in view of the fact that these compounds (Korogel and Korolac) are not pre-heated by steam and would be ruined if carried to 525° F. In all other respects, the article was correct.

Owner's of Noble's "Latex in Industry"

The author has prepared an addenda and errata list which represents not only errors in patent numbers and typography but which includes a number of references originally omitted from the book. This list, in printed form which may be readily pasted into the original copy, is available without cost to all purchasers of the book. Address requests to THE RUBBER AGE, 250 West 57th Street, New York City.

Book Reviews

The Accelerated Vulcanization of Rubber. By Torbjorn Greness. (Translated from the Danish by Monica S. Greness and Alexander C. Jarvis.) Published by Williams & Norgate, Ltd., London, England. 120 pp.

Representing a treatise submitted to the Royal Technical College, Copenhagen, Denmark, for the degree of *doctor technices,* which was accepted on December 31, 1936, this book consists of a series of investigations including studies upon the effect of glue and a new method of measuring the tear resistance of rubber. It is divided into three sections, e. g., A Summary of the Various Theories on the Reactions of Accelerators, Especially of Dithiocarbamates and Thiuram Sulphides; Physical and Chemical Investigations; and Practical Application of the Results, More Especially the Use of Glue in Rubber Compounds. Included among the author's summation of his experiments are two interesting observations: (1) that water is of great importance in the process of vulcanization and that its activating effect is bound up with the presence of metal oxides; and (2) the presence of aqueous glue (in a rubber compound) is of particular assistance in the retention, even under unfavorable conditions, of sufficient humidity to ensure a constant rate of vulcanization.

•

The Rubber Book. By William Clayton and Helen Sloman Pryor. Published by Harcourt, Brace and Co., 383 Madison Avenue, New York City. 100 pp. 6 x 9 in. $1.00.

This book is one of a series of story-picture books on important industries written and prepared by Mr. and Mrs. Pryor. The purpose of these books is to present specific information to gratify children's curiosity without confusing them by too many details. The Rubber Book is evenly divided with text and photographs, many of the photographs being originals. Each text page is devoted to some other phase of rubber—from cultivation to use—while the pictorial illustration on the opposite page bears out the text. Although told in story-book fashion, and intended for children, the accurate tracing of rubber from plantation to use, plus the attractiveness and distinction of most of the photographs, recommends this volume to adult attention.

•

Compounding Materials Used in the Rubber Industry (Classification and Health Hazards). National Safety Council, 20 North Wacker Drive, Chicago, Ill. 16 pp. 8½ x 11 in.

Including material from papers presented at various meetings of the Rubber Section of the National Safety Council, this pamphlet has been revised and brought up to date by L. J. D. Healy, technical superintendent, Fisk Rubber Company, Cudahy, Wisconsin. It is a compilation of experience in accident prevention and should not be confused with Federal, State or insurance requirements or with national safety codes. Accelerators, antioxidants and dry organic compounds are classified by chemical groups and the origin, constitution, uses and health hazards of each group are given. The pamphlet is recommended to every rubber executive entrusted with plant safety.

•

Tag Non-Indicating Temperature and Pressure Controllers. (Catalog No. 900C.) C. J. Tagliabue Mfg. Co., Park and Nostrand Avenues, Brooklyn, N. Y. 32 pp. 8½ x 11 in.

The latest models of Tag non-indicating controllers for temperature, pressure and time, are illustrated and described in this new catalog. In addition to the instrument listings, the catalog contains a comprehensive discussion of the various types of controllers, their applications and their workability. Specific reference to applications in the rubber industry is made throughout the book.

Industrial Shop Lighting. (Safe Practices Pamphlet No. 22.) National Safety Council, 20 North Wacker Drive, Chicago, Ill. 12 pp. 8½ x 11 in.

Revised by a sub-committee of the Newark (N. J.) Safety Council, in cooperation with W. Dean Keefer of the National Safety Council, this pamphlet is based on the accident prevention experience of a number of employers in various industries. It deals with natural and artificial lighting, and discusses such subjects as wiring, reflectors, room condition and maintenance, lamps, lamp renewals, mercury vapor lamps and tubes, designing a lighting system, etc. According to the pamphlet, 10 to 20 footcandles is recommended as a standard of illumination for various operations in rubber factories.

•

An Album of Familiar Belts. Mechanical Goods Division, U. S. Rubber Products, Inc., 1790 Broadway, New York City. 6 x 8 in.

Designed to represent an album, this folder contains twenty-five reproductions of photographs taken in the field and in the factory, the pictures showing a wide variety of transmission belt installations in different industries. Included among these pictures are several interesting studies taken by Margaret Bourke-White, famous photographer, at U. S. Rubber's Passaic (N. J.) laboratory and factory. Information pertinent to each installation or describing each process is on the back of each picture.

•

Johns-Manville Packings. Johns-Manville Corporation, 22 East 40th Street, New York City. 48 pp. 7½ x 10 in.

The widely varied line of packings—of all types, sizes and styles—featured by Johns-Manville are completely described and efficiently illustrated in this catalog. Such information as gasketing instructions, packing symbols, numerical indexing of packings, weight, methods of packaging, etc., is given. The J-M packing service is also described. The catalog concludes with brief descriptions of other products manufactured by the company, including refractory cements, friction materials and insulation.

•

The ABC's of V-Belts. Dayton Rubber Manufacturing Company, Dayton, Ohio. 40 pp. 8½ x 11 in.

Dedicated to the company's distributor salesmen "to simplify their daily work", this informal book is exactly what its name implies—an ABC of V-belts. In simple language, borne out by crude but analogous drawings, and supported by photographic illustrations, the book gives the fundamental principles of the V-belt in easy-to-understand fashion. Construction, uses and advantages of V-belts are described.

•

Consolidated Odor Adsorbers in Air Conditioning. Consolidated Air Conditioning Corporation, 114 East 32nd Street, New York City. 9 x 11½ in.

Covering the question of the cost involved in operating an air conditioning system, this booklet dwells upon the savings which may be effected by the use of the company's odor adsorbers due to the reduction in the amount of fresh "make-up" air. A set of tables showing the savings for various air volumes is included. Benzol, alcohols, mercaptans, acetone and turpentine are among the many gases and vapors the company's odor adsorber will completely remove from the air, according to the booklet.

•

Nukraft-Elastic Spring Covering for Upholstered Seats. B. F. Goodrich Company, Akron, Ohio. 7½ x 10 in.

A few uses of Nukraft, the latex-impregnated hair material introduced by Goodrich about two years ago, are given in this pamphlet, including its use in the automotive, aviation, marine, theatre, bus, truck, street car and railroad industries. Its use in mattresses and as furniture upholstering is also briefly described.

Editorial Comment

Regulation of Rubber Prices

WITH the consumption of crude rubber increasing and the available supply decreasing, it is inevitable that crude rubber prices go up . . . and so they have. American rubber manufacturers, recalling with industrial shudders the disastrous days following the collapse of the Stevenson plan more than a decade ago, have petitioned their government to take what steps it can to avoid history repeating itself. Acting upon these requests, the American Government has registered official protest with England. Thus far all steps have been in logical sequence.

When the International Rubber Regulation Committee started to function it avowedly had two major aims: (1) to reduce excessive available stocks; (2) to "regulate" the price of rubber to a point where producers could earn a "respectable" profit. That the first aim has been reached is only too well realized. Not only have stocks been substantially reduced, but reduced to a point where the world faces a rubber shortage. What more evidence is needed other than the Restriction Committee's move in setting the permissible quota for the third and fourth quarters of this year at 90%.

It is on the second aim that controversy rages. Skipping all of the pros and cons the question comes down to simply this: What is a fair and justifiable price per pound for rubber? According to American manufacturers a price of 18 cents per pound is sufficient to enable producers to show respectable profits and to pay dividends to investors. According to investors in rubber plantation companies a price nearer 25 cents per pound is more in keeping with their investments. Rubber plantation owners and operators have been strangely silent on the question.

E. G. Holt, assistant chief of the Leather and Rubber Division of the Bureau of Foreign and Domestic Commerce, in a recent talk before the Boston Rubber Group, claimed that an 18 cents per pound price was not only fair to both producer and consumer but to all other interested parties. He stressed the point that in the lean years of 1929-33 plantation operators had introduced definite economies in the cultivating of rubber while the price was under 15 cents a pound and that these same economies apply to rubber at 18 cents per pound, giving the producer a greater margin of profit.

That Holt's figures and figuring approach accuracy is indicated in statements covering the year of 1936 released by plantation companies. For instance, both the Krian Rubber and Java Rubber Plantations recently revealed that they had trebled profits during 1936 over the 1935 figures. In 1935 the average price of crude rubber in the New York market was 12.37 cents per pound and in 1936 it reached 16.41 cents per pound. And the permissible quota for 1936 was approximately 70%. Certainly, therefore, at a price of approximately 18 cents per pound with 85 to 90% of permissible quotas these same companies can again almost treble their profits during 1937.

It should be pointed out at this time, however, that American rubber manufacturers are not particularly concerned over the price of rubber per pound unless it reaches outlandish proportions as it did after the collapse of the Stevenson Plan. They are primarily concerned with a *stabilized* price, whether it is 18, 20 or even 25 cents per pound. Especially is this true of the average rubber manufacturer whose operating capital permits only normal purchases of rubber.

The International Rubber Regulation Committee has proven that it can regulate supply, what it can do to "regulate" the price situation remains to be seen.

Why the Strike at Firestone?

AT this writing the situation at the Firestone factory in Akron is still deadlocked—after six full weeks of inactivity. Neither side seems willing to grant an inch. The union insists on recognition as the sole collective bargaining agency for all Firestone workers, as well as abolition of the employees' conference plan and an agreement to negotiate on the question of hours, wages and working conditions, while Firestone refuses to negotiate on either sole recognition or abolition of the employees' conference plan "since they deal with the personal rights of our employees."

That the rubber union, affiliated with John W. Lewis' C.I.O., must back water on its demands for recognition as the sole bargaining agency for all Firestone workers seems evident from the settlement of the recent General Motors and Chrysler difficulties. The Automobile Workers Union is one of the C.I.O.'s strongest unions. It, too, presented demands for sole recognition as the bargaining agency in all automotive plants, but even the unpredictable Mr. Lewis finally saw fit to temper this demand to include only members of the union itself. In a letter to the union heads from J. W. Thomas, Firestone president, the company willingly agreed to negotiate with the rubber union on the questions of wages, hours and working conditions.

In view of the fact that elimination of the demand for recognition as the sole collective bargaining agency plus that for abolition of the Firestone employees' conference plan would restore harmony, it seems sort of shameful to keep some 10,000 workers out of jobs. This question might also be raised: Why the strike in the first place?

CURRENT • NEWS of the Rubber Industry

APRIL, 1937

AMERICA PROTESTS RUBBER SITUATION

Official Protest is Made to England by American Embassy Over Continued Rising Prices Which Will Seriously Affect Manufacturers

Growing concern of American rubber manufacturers over the status of the crude rubber situation brought about by the operation of the current restriction scheme has led to an official protest by the Government to England, the prime factor in the rubber cartel. Late last month Ray Atherton, counsel to the American Embassy in London, communicated this concern to British authorities. It has been learned that the Embassy had been discussing the effect of restriction on the supply and ultimate price of rubber products manufactured in this country over a period of time.

No Price Control

The main concern of American manufacturers centers around the fact that the International Rubber Regulation Committee has no method of controlling the price situation which gives indication of getting out of hand again as it did in the third year of the Stevenson plan. Each month sees a depletion of available world stocks, despite the action of the Restriction Committee in raising permissible quotas, set at 90% for the third and fourth quarters of the year at a meeting held in London on March 16th. Permissible quota for the April-June period remains at 85%. Quota for January-March was 80%.

Consumers of rubber are also seriously disturbed at reports of labor disturbances in the Far Eastern territories. In several areas entire plantations have been crippled by strikes, and on one large plantation the coolies emulated the latest tactics of American labor by staging a sit-down strike.

It has already been publicly stated by officials of the Restriction Committee that it is extremely doubtful whether producing countries could fill their permissible quotas for the first six months of 1937, although officials of the Netherlands East Indies claim that Java can produce the full basic quota and Sumatra should be able to within the next few months. At this writing, practically every producing country involved in the cartel is behind its permissible quota.

A good deal of the industry's troubles with regard to rising rubber prices is laid at the door of speculative interests. With rubber consumption increasing and stocks falling off, these interests have taken an active part in market operations and it is highly to their advantage to force the price of crude rubber up to higher channels. Prof. Van Geleren, Dutch delegate to the International Rubber Regulation Committee, is credited with the statement that if speculation drives prices still higher there is a possibility that restriction will be abandoned.

Tire and Tube Levy

In his budget message to Congress recently President Roosevelt requested the renewal of nineteen "nuisance" taxes, pointing out that termination of these taxes would trim next year's revenues considerably. The levy on tires and tubes was one of those to be continued. According to the President's message, a yield of $29,750,000 is estimated from the special taxes on tires and tubes.

LATE NEWS BRIEFS

The Firestone strike is still at an impasse at this writing (April 12) although negotiations have been resumed after a lapse of several weeks. The union is insistent on its demand for recognition as the sole collective bargaining agency for all Firestone workers. The Akron factories have been shut-down since March 6th. Strikes are also current at the Thermoid plant in Trenton, N. J., and the Philips-Baker Rubber Co., Providence.

Charles C. Davol, president and treasurer, Davol Rubber Co., Providence, R. I., died at the age of 69 on April 11 in the Post-Graduate Hospital, New York City.

The Chicago Group, Rubber Division, A.C.S., will meet on April 30 at the Hotel Sherman. H. D. Bainbridge (Anaconda) and F. G. Arnold (Rapid Roller) will be the speakers.

MACHINERY ORDERS AWARDED BY FORD

National Rubber Machinery Receives Largest Single Order Ever Awarded for Tire Equipment, Said to Total Over $1,000,000

What is believed to be the largest single order for tire manufacturing equipment ever placed has been awarded by the Ford Motor Company to the National Rubber Machinery Company, Akron. The contract, calling for tire vulcanizers and mold equipment, is said to total upwards of $1,000,000. Neither the Ford or National companies would discuss the contract other than to admit its authenticity.

An order for mixers and mills is also believed to have been placed with the Farrel-Birmingham Company, Ansonia, Connecticut, while it is known that the Vaughn Machinery Company, Cuyahoga Falls, Ohio, has already produced several pieces of special machinery to order. Another concern believed to have received an order from Ford is the Adamson Machine Co., Akron.

Excavation Work Started

Despite characteristic secrecy, it is definitely known that excavation work has been started at their tire plant activities with character at River Rouge, Michigan. The new building is expected to cost approximately $1,500,000, to be of brick and steel structure, and to provide 450,000 square feet of floor space. According to estimates, it will be completed within five months and tire production will probably be started before 1938.

A clew to the time when the Ford tire factory will start operations is expected to be revealed when the company places its first order for crude rubber supplies. Brokerage houses report that to date Ford has not placed an order for a single pound of rubber. It is not expected that rubber will be forthcoming from Ford's Brazilian plantations to any great extent for some time.

At present, Firestone, Goodyear and U. S. Rubber are supplying Ford with its original tire equipment, with Firestone reported to be supplying approximately 50%. According to rumor, Goodyear and U. S. Rubber will be the losers when the Ford factory gets under way.

STOCKHOLDERS TOLD STATUS OF GOODYEAR

Revealing that net earnings for 1936 — which totaled $10,831,031 — were the highest earned by the Goodyear Tire and Rubber Company since 1929, Paul W. Litchfield, president of the company, told stockholders at their annual meeting held in Akron on March 29th, that the recapitalization program has enabled Goodyear to eliminate all accumulated dividends on its second preferred stock and to pay a dividend on its common stock.

Pointing out that consumption of crude rubber in the United States last year reached the unprecedented total of 573,000 tons, 22% above that of 1929, he stated that this increase was due to the demand of the motoring public for larger tires, the growing use of pneumatic tires on trucks and buses and the new industrial uses of rubber. He predicted a growing trend toward the use of pneumatic tires on farm equipment, estimating that there are approximately 40,000,000 steel wheels on American farms constituting a possible market.

Discussing the effect of restriction on crude rubber prices, Mr. Litchfield said that one effect of the rise of these prices has been of particular advantage to Goodyear in the rapidly mounting earnings of the Goodyear Rubber Plantations Company. He stated that the Goodyear plantations in Sumatra, the Philippines and Central America now total about 95,000 acres, of which 56,000 acres are planted and 25,000 acres are in production. By 1939 the company expects to have 53,000 acres in production. Due to scientific experimentation and the development of bud-grafting, he stated that the annual yield per acre may be as much as 50% greater than the current yield of approximately 670 pounds per acre obtained from the first plantations set out in Sumatra.

Discusses Decentralization

Touching on decentralization activities, the Goodyear president made the assertion that in any manufacturing enterprise a point is reached where the law of diminishing returns makes its effect felt. As an example, he stated that a 5,000 tire plant operating at continuous capacity on a standardized line of units is efficient and economical, whereas certain losses of efficiency are encountered on 20,000 to 40,000 tire plants where there are seasonal ups and downs along with a widely diversified line of sizes. In addition, if the smaller plant is well situated marked economies can be achieved in transportation costs of both raw materials and finished products.

Since the policy of decentralization was instituted by Goodyear there has been no extravagant abandonment of existing facilities, according to Mr. Litchfield, who revealed that although important additions to the company's productive capacity outside of Akron have been made since 1929, the real property account is carried on the books at approximately $76,000,000, as contrasted with $102,000,000 seven years ago.

In concluding his talk to the stockholders, he discussed the policy of decentralization in the export field followed by Goodyear and stated that the plants in England, Australia, Argentina and Java represent $55,756,369, or 27% of the company's total assets.

DuPont Sponsors Exhibition

A comprehensive exhibit of the important contributions which have been made by chemistry to everyday living has been organized and installed in the New York Museum of Science and Industry, 30 Rockefeller Plaza, New York City, by E. I. du Pont de Nemours and Company, Inc. The exhibit includes various products developed and introduced by du Pont, including neoprene (formerly termed DuPrene). It was formally opened on March 31st with appropriate ceremonies, including brief talks by Lamont du Pont and Dr. C. M. A. Stine, president and vice-president of the company, respectively.

WITCO CHANGES NAME TO CONTINENTAL CO.

In order to avoid confusion and conflict in names, the corporate name of the recently organized Witco Carbon Company has been changed to the Continental Carbon Company. The change is in name only and in no way affects the personnel, officers or directors, according to Robert I. Wishnick, president of the company.

At the same time it was announced that additional units of the plant at Sunray, Texas, have been placed in production. The company expects to operate the Sunray plant at full capacity in the near future.

Don M. Welch has been appointed rubber chemist of the Sunray laboratories. Mr. Welch, a graduate of chemistry at Ashland College, was for four years assistant to the chief chemist of the Mansfield Tire and Rubber Company and for the past six years has been engaged in the development of mechanical goods for the Bearfoot Sole Company, Barberton, Ohio.

RUBBER USED IN NEW FORM OF TREE SURGERY

Left: Close-up showing method by which rubber strips are cut and fitted to cavities. Right: Sealing the cavity of one of the trees originally planted by Thomas Jefferson.

After several years of experimenting with various materials in an effort to determine that best suitable to preserve old and deteriorating trees, George Van Yahres, noted tree surgeon, in cooperation with the laboratories of the B. F. Goodrich Company, has developed a rubber ideally suitable for this purpose. The rubber is specially compounded to withstand continuous flexing and long exposure to sunlight and extreme temperature changes, and is made up in strips of approximately 1½-inch width by 1¼-inch thickness. In application, the decayed area is removed from the tree, the cavity is walled up with rubber strips cut so that their length is slightly greater than the width of the cavity so that the ends of the strips will compress against the sides of the cavity to give an absolutely tight seal. One strip is laid upon another, and as the wall of rubber is built up the remainder of the space back of it is filled with a cementitious mixture designed to absorb moisture. The inside surface of the rubber strips contains a series of small double dovetails which are embedded in the cement to prevent pulling away from the filling.

N. Y. RUBBER GROUP HEARS DR. HAUSER

A talk on "Colloidal Materials" by Dr. E. A. Hauser, associate professor at Massachusetts Institute of Technology and noted latex technologist, featured the Spring meeting of the New York Group, Rubber Division, A.C.S., held on April 2nd at the Building Trades Club, New York City. Approximately 225 members and guests attended the meeting, which was presided over by Vice-Chairman C. A. Bartle. Chairman J. Miscall, due to his father's sudden death, was unable to attend.

After the usual excellent dinner, Mr. Bartle opened the meeting with the announcement that the fourth annual outing will be held early in June, probably on either the first or second Saturday. Although no chairman or committee has yet been selected for the outing, members of the Group were asked to forward any suggestions as to time and place direct to Chairman Miscall. The speaker of the evening was then introduced.

Interspersing his remarks with humorous off-sides, Dr. Hauser pointed out in his introduction that colloid chemistry and physics, according to the modern definition, not only cover the study of suspensions or emulsions in which the dispersed solid or liquid are present in extremely fine comminution, but that they also cover studies on surfaces or interfaces and reactions taking pl ce therein. Colloid chemistry, therefore, according to the speaker, "is not of importance only in the field of rubber latex where problems of colloidal dispersion of the hydrocarbon, as well as of the compounding matter are predominant, but also work with crude milled rubber should be considered more from a colloidal point of view."

Surface Study Required

Dr. Hauser indicated that a closer study of the surface condition and reactivity of the most generally used compounding ingredients would materially assist in obtaining a better insight into changes in the properties of the compound occurring due to their addition. But, above all, a better knowledge of the compounding matter, from a colloidal viewpoint, would unquestionably permit different treatments of the compounding ingredients, so that, for instance, fillers which are today considered absolutely inert and therefore valued only as diluents of the mix could be transformed into fillers conferring definite valuable properties to the stock. A more correct understanding of these surface reactions should assist us in obtaining better control on accelerator adsorption, improving tear resistance in a variety of stocks, etc., he stated.

In referring to the problem of vulcanization of crude rubber as well as of latex, Dr. Hauser observed that we are still lacking a final answer to the problem. He expressed the hope that with our increased knowledge of rubber structure and its colloidal properties and materially improved methods of studying chemically and physically minute changes in the unsaturation of hydrocarbons, it should be possible to approach the problem from entirely new angles and obtain a satisfactory answer.

In concluding his talk, the speaker once more referred to latex, and after having pointed out that all concentration processes of latex, as protective evaporation, centrifuging, creaming, filtration, dialysis are based on typical colloidal reactions, he drew attention to the importance of the surface tension of latex or latex compounds in various applications, especially in dipping operations. He briefly discussed work on surface tension now being conducted at M.I.T. by the use of the Edgerton high speed motion camera technique and demonstrated a series of pictures of the bursting of a latex web obtained by dipping a fork-shaped glass rod into latex. The pictures were taken at a speed of about 2,000 exposures per second.

Noted Guests Introduced

In his concluding remarks Dr. Hauser made mention of the fact that the Group was fortunate in having several distinguished technologists present. One of these, Dr. K. Soellner, first assistant to Professor Freundlich of the University College of London, was called upon by the presiding officer, and spoke briefly on a few aspects of colloidal chemistry. He substantiated Dr. Hauser's remarks and stressed the importance of cooperation between the commercial laboratory and the pure research worker. Based on experiments currently being conducted at the University College of London, and those of Dr. Hauser at M.I.T., Dr. Soellner predicted that our knowledge of colloids and their real importance to industry, would soon be vastly improved.

Another distinguished visitor was Dr. Hans W. Albu, chief chemist, Beyersdorf A.G., Hamburg, Germany, one of Dr. Hauser's collaborators on his "*Handbuch der Gesamten Kautschuktechnologie.*" Although called upon to speak, he politely declined because of his limited knowledge of English.

The entertainment part of the evening's program was furnished by William Kelgard, a rapid-fire monologist, introduced as "Congressman Oliver of Summit County." Displaying a fair knowledge of conditions in the rubber industry, he drew upon his repertory of humor to deliver a well-received monologue.

Boston Meets on May 7

A meeting of the Boston Group, Rubber Division, A.C.S., will be held on May 7. The principal speaker will be Dr. A. R. Kemp of the Bell Telephone Laboratories, New York City, on the subject of "Developments in Rubber as a Dielectric Material." Although the place of meeting was not designated in the early announcement, it is presumed it will be the Hotel Kenmore, in Boston. Dr. Royce J. Noble, 21 Woodland Road, Malden, Mass., is chairman of the Group.

An index to Volumes 39 and 40 of THE RUBBER AGE will be found facing page 64 of this issue.

DR. TULEY ADDRESSES THE CANADIAN GROUP

The Rubber Section of the Toronto Chemical Association held a regular dinner-meeting on March 12th at McMaster University, Hamilton, Ontario, under the chairmanship of R. G. Stewart. Despite poor traveling conditions, due to heavy snows, 44 members and guests attended.

The principal speaker for the evening was Dr. W. F. Tuley of the Naugatuck Chemical Division, U. S. Rubber Products, Inc., whose subject was "Vulcanization Accelerators." Dividing his subject into three main divisions, e.g., Mechanism of Action, Chemical Composition and Properties, and Relation to Properties of the Vulcanizate, Dr. Tuley first gave the history of the process of vulcanization, starting with Charles Goodyear's discovery in 1839, tracing it through Oenslager's work on organic accelerators, and continuing up to latest developments.

Classifying present day important commercial accelerators under three types—organic bases, carbo-sulfhydryl and miscellaneous—the speaker gave a brief picture of the properties and uses of each specific type, illustrating many of his points by actual examples. Included among the types of accelerators described were the aliphatic and aromatic amines, aldehyde amines, guanidines, thio ureas, thiazoles, dithiocarbamates and certain non-nitrogen accelerators, such as the xanthates, dithio acids and trithio carbonates.

Discussing the question as to why the rubber industry uses a wide variety of chemicals for accelerating vulcanization, Dr. Tuley stated that the fundamental reason is that "rubber is used in such a variety of ways and manufacturing methods are so variable that the industry needs a wide choice of accelerators." As a second reason he stated that "competition among rubber manufacturers and the suppliers of chemicals for the industry results in a procession of new accelerators giving some advantage over the older materials."

At the conclusion of his paper, Dr. Tuley answered questions raised by his listeners for almost a full hour, according to A. Briant of the Viceroy Manufacturing Company, secretary of the group.

Chicago Hears Somerville

Repeating his talk on the importance of maintaining a well-equipped and well-manned laboratory, which he delivered at the March 12th meeting of the Rhode Island Rubber Club, Dr. A. A. Somerville, of the R. T. Vanderbilt Company, New York City, was the principal speaker at a meeting of the Chicago Group, Rubber Division, A.C.S., held at the Hotel Sherman on March 26th. Dr. Somerville also presented the series of stills and motion pictures taken on a recent trip through Mexico, including scenes in a rubber factory using guayule rubber and a bull fight. The usual dinner in the College Inn of the Hotel Sherman preceded the meeting.

LOS ANGELES GROUP HEARS SOMERVILLE

Dr. A. A. Somerville of the R. T. Vanderbilt Co., repeating his previous talks before the Rhode Island and Chicago Rubber Groups on the value of the laboratory to rubber manufacturers irrespective of the size of their plants, and showing moving pictures of his recent Mexican trip, was the chief speaker at the April 6th meeting of the Los Angeles Group, Rubber Division, A.C.S., held in the Rainbow Room of the Hotel Mayfair, Los Angeles. Eighty-eight members and guests attended the meeting which was presided over by Chairman T. Kirk Hill.

"No matter how small your plant is," said Dr. Somerville in his address, "if you have no laboratory you should begin to equip one. Do not put it in a dark corner but make working conditions in it as good as the best in the factory. Your future success will depend upon what comes out of the laboratory for upon new products the greater profits must come. My first laboratory consisted of two men, one other beside myself, plus one baseball bat. The bat was used to drive back rats that constantly poked their heads in through holes in the wall. That laboratory has grown; so will yours." In addition to the motion pictures, Dr. Somerville also presented several graphs showing the relative importance of the United States, Canada and Mexico as present and potential markets for rubber materials.

Committees Make Reports

Following this presentation, a humorous talk was given by an actor and reader calling himself Dr. Josephus Forrestus, "The King of Pain." Dick Newell, chairman of the Golf Committee, then rendered a report indicating an increasing interest in the sport by the group. He stated that in a tournament played on March 12th, James W. Stull (Santa Fe Rubber Mills) won first honors, and announced that an unnamed donor was ready to furnish a tournament award providing twenty-five players participated in each tournament.

A report by R. D. Abbott (C. P. Hall), chairman of the Membership Committee revealed a present membership of 163. A show of hands indicated that 20 members and guests were in favor of another Summer fishing trip under the leadership of Ed Royal, chairman of the Program Committee.

The door prize for the evening, a thermos bottle and glasses, donated by W. D. Schwartz (L. H. Butcher), was won by Phil Ritter (U. S. Rubber). A second prize, donated by William Shawger (D. and M. Machine Works), a chromium plated waffle iron, went to B. E. Dougherty.

The May meeting, which will be held on May 4th at the Hotel Mayfair, will be the last indoor meeting of the season, the gatherings during the Summer months generally comprising outdoor events, chiefly fishing trips and golf tournaments. Prizes for the May meeting will be donated by J. Edward Tufft, correspondent for THE RUBBER AGE.

New Tire Problem

In many sections of the country a new type of corrugated road construction is being adopted. In many cases the roughening is done by running a cleated wheel over the road. The corrugations in the road surface cause vibration and noise, however, when cars go over them. Since arranging the spacing of tread blocks has reduced the ordinary noise which came from the regular impact of the tread blocks against the pavement, U. S. Rubber engineers have suggested that a slight staggering of the road marks in a systematic manner will break up the impulses transmitted to the car and greatly reduce the noise which now exists. They also predict that as, if and when both the road surface and tire treads have the same irregular spacings, the whine or "pitched" noise which comes from regular impacts will be entirely eliminated.

R. I. RUBBER CLUB HAS SPRING MEETING

One hundred and thirty-seven members and guests attended the Spring meeting of the Rhode Island Rubber Club, held at the Narragansett Hotel in Providence on March 12th. The principal speaker of the evening was Dr. A. A. Somerville of the R. T. Vanderbilt Company, New York City.

Actually dividing his presentation into two parts, Dr. Somerville first delivered what he termed "a sermon on the technical service which you give to others." Centering his remarks on the importance of maintaining a well-equipped laboratory, he stressed its ultimate effect on the profitable service given to customers. He also made mention of the fact that since research makes possible the items which the sales department turns into profits, the laboratory should be given more than casual attention.

Following the "sermon," Dr. Somerville presented both still and motion pictures he had taken during a recent visit to Mexico, describing the various scenes which included views of a Mexican rubber factory using guayule rubber as well as a picturesque bull fight.

After Dr. Somerville's presentation, Chairman F. E. Rupert introduced Dr. Wallace Bohrer, toxicologist of the Rhode Island Public Health Department and consulting chemist to the State Police, who spoke on "Scientific Detection of Crime." He clearly demonstrated by case examples how chemistry is playing an important role in aiding the police to solve many crimes which, he claimed, could not be solved by any other means.

Another speaker was Lieutenant Urquhart, who appeared in place of Edward J. Kelly, Superintendent of the Rhode Island State Police, scheduled to address the meeting. Lieutenant Urquhart substantiated the first speaker's remarks.

AKRON GROUP MEETS AND ELECTS OFFICERS

Election of officers and a talk on air transportation featured the meeting of the Akron Group, Rubber Division, A.C.S., held on March 19th at the Akron City Club. One hundred and seventy-four members and guests were present at the dinner prior to the meeting, while approximately 200 gathered to hear the speaker for the evening, Captain E. B. "Brownie" Grey, of the United Air Lines.

Selecting as his subject "Behind the Scenes," Captain Grey discussed the rapid strides in service, dependability and technical development which have taken place in air travel in the past seven years. He described the various navigational instruments which are now part of every airplane's equipment and pointed out the safety factor of each. The public's acceptance of the service offered by domestic airlines, according to the speaker, is evidenced by the fact that in 1935 the airlines in this country flew more than 300,000,000 passenger miles, more than 8,000,000 mail-pound miles and more than 2,000,000 express-pound miles.

At the conclusion of this address, the Nominating Committee made its report and the following officers were elected for the ensuing year: chairman, G. Lloyd Allison (Goodrich); vice-chairman, A. E. Warner (C. P. Hall); and secretary-treasurer, H. V. Powers (Goodyear).

RUBBER NOVELTIES SHOWN AT TOY FAIR

The 1937 American Toy Fair, sponsored by the Toy Manufacturers of the U. S. A., Inc., opened at the Hotel McAlpin in New York City on April 5th. It is scheduled to continue until April 17th. The Fair was said to be the largest in several years, with attendance in the first few days surpassing all previous records.

Several new novelties are being displayed by rubber manufacturers in exhibits at the McAlpin, including the following: an all-rubber tractor by the Auburn Rubber Corp.; a molded "Elmer Elephant," one of Walt Disney's latest characters, by Seiberling Latex Products Co.; an inflated "Kiko, the Kangaroo," by Miller Rubber Co.; etc. Other rubber manufacturers displaying their wares at the McAlpin includes the Lee-Tex Rubber Products, Pennsylvania Rubber, Perfect Rubber, Seamless Rubber, Sun Rubber and C. B. Webb companies.

A number of manufacturers are displaying toys and novelties which incorporate rubber in their construction. One of these which attracted a good deal of interest was the "Roll-King" roller skates, a product of the Metal Specialties Mfg. Company, of Chicago, which features rubber wheels, is mounted on rubber to furnish a "floating ride," and has a rubber cushion on the surface so that soles and heels grip firmly.

NEW ENGLAND NEWS

Control of industrial dust conditions in Connecticut factories, now a joint responsibility of the State Departments of Health and Labor, is the subject of a dispute in legislative circles, with each department seeking to be designated as the sole agency in handling the matter. The Manufacturers' Association of Connecticut, in which most large Connecticut rubber companies hold membership, opposes the plan to give jurisdiction to the Labor department. Representatives of the two departments supported their respective bills at a hearing March 11 before the Public Health and Safety Committee of the General Assembly.

Comparatively little labor trouble had developed in New England rubber manufacturing plants up to April 1st, although there were serious outbreaks in other industrial lines. In Connecticut, about 60 employees of the Elm City Rubber Company, New Haven, walked out on March 23, demanding higher wage rates, shorter hours and improved working conditions. Charles A. Blake, president and treasurer, announced he would move the plant unless the employees returned to work.

United States Rubber Products, Inc., Naugatuck, Conn., has let contracts for an addition to its central office building on Maple street, which will contain 6,000 additional feet of floor space and cost $20,000. The structure will be two stories, 40x75 feet, and when finished will make in conjunction with two rooms now in existence in the building a room 75x80 feet on each floor. Desks and equipment will be rearranged to provide for greater efficiency.

Herbert E. Tolman, chief control chemist of the Fiberloid Corporation, Springfield, Mass., spoke on "Plastics" at a joint meeting of the Western Massachusetts Engineers' Society and the Connecticut Valley Section of the American Chemical Society on March 16 at Hotel Highland, Springfield. He exhibited many items made of plastic material and said his company is now able "to make better ivory than an elephant, grain and all." About 85 chemists and engineers attended the meeting.

Kerite Insulated Wire & Cable Company, Seymour, Conn., has announced a full week's vacation with pay for all plant employees this Summer. The factory will close for the week of July 5 to 10 and all workers on the payroll the preceding week will receive vacation pay on the basis of a 50-hour week. Richard D. Brixey is president of the company and C. L. Smith is plant manager.

About 500 employees of the Goodyear Rubber Company, Middletown, Conn., laid off due to a weather-induced drop in the demand for rubber footwear in February, have been re-employed. Vice-President Arthur V. McDowell has stated that operations will now be continued without further shutdowns.

C. H. Daniels Products Company, 65½ Riverdale Avenue, East Port Chester, Conn., and its affiliate, Safetex Company, Inc., at the same address, have filed organization papers. The Daniels company, authorized to deal in rubber latex, compositions of cork, etc., has an authorized capitalization of $50,000, with $1,150 paid in. Claude H. Daniels of Wellesley Hills, Mass., is president and treasurer; Dorothy Daniels, vice-president; and John H. Maize, Brookline, Mass., secretary and assistant treasurer. The Safetex Company has a paid-in capitalization of $20,000. Raymond Healy, of White Plains, N. Y., is president and assistant treasurer; Alvah G. Sleeper, West Somerville, Mass., secretary; and Mr. Daniels, treasurer. The officers of both concerns are also directors.

A court order has been issued in New Haven, Conn., accepting the final report on the dissolution of the Rubbercraft Corporation and discharging the receiver.

The Naugatuck Chemical division of United States Rubber Products, Inc., has started construction of several additions and a new building at its Elm Street plant, at a total cost of about $4,000.

C. T. Manville, general manager of the Shoe Hardware Division, U. S. Rubber Products, Inc., Waterbury, Conn., has announced a general increase affecting all wages rates beginning April 12, which applies to 400 employees. The amount of the increase was not disclosed. The Shoe Hardware Division manufactures buckles, slide fasteners and other metal parts for rubber footwear.

Cabot Plans Expansion

Godfrey L. Cabot, Inc., Boston, Mass., manufacturers of Spheron carbon black, will spend approximately $4,000,000 in plant expansion this year, according to an announcement from the company. This includes an addition to the carbon black plant in Stinnett, Texas, completed last month, new plants at Wickett and Kermit, Texas, as well as a new gasoline plant and new natural gas pipe lines. When the carbon black plant is completed, the company will increase its production capacity about 30%. The plants at Wickett and Kermit are being especially designed for making bulk shipments. The company has ordered 20 additional freight cars to handle the transportation of its Spheron black in bulk.

PREPARING SECOND LATEX BIBLIOGRAPHY

Frederick Marchionna, compiler of the bibliography, *"Latex and Its Industrial Applications"*, published by THE RUBBER AGE in 1933, has completed the compilation of a second edition covering the patents and literature since the first book. The text is now in the hands of the printer and the book will be available in the next several months.

The amount of new material is so vast that the new edition will be issued in two volumes, Vol. II and Vol. III, and will include abstracts of work on Rubber Derivatives as well as Latex. Many chapters will include comprehensive articles written by recognized authorities in their respective fields. Among the internationally-known rubber technologists who have contributed articles are J. McGavack, P. Schidrowitz, C. Beal, A. Szegvari, D. F. Twiss, H. L. Fisher, L. Sebrell and others whose manuscripts have not yet been received.

The new edition will comprise 22 chapters and total approximately 1500 pages in both volumes. The range of subjects will cover latex and rubber derivatives from all angles from the plant stage to industrial applications.

The supply of copies of the first issue of *"Latex and Its Industrial Applications"* is rapidly nearing exhaustion. This first edition sells at $15.00 per copy and is available from THE RUBBER AGE, 250 West 57th Street, New York City. Although no selling price has been as yet determined for the two new volumes, it is expected to be under $20.00.

CONSUMPTION GAINS 3.2% IN FEBRUARY

Consumption of crude rubber by manufacturers in the United States for the month of February is estimated to be 50,282 long tons, which compares with 48,744 long tons for January. February consumption shows an increase of 3.2% over January and is 36.8% above February a year ago according to statistics released by the Rubber Manufacturers Association. Consumption for February, 1936, was 36,746 long tons.

Imports of crude rubber for February are reported to be 43,289 long tons, an increase of 31.9% over the January figure of 32,820 long tons, and 22.9% over the 35,219 long tons imported in February, 1936.

Total domestic stocks of crude rubber on hand February 28, are estimated at 193,864 long tons, which compares with January 31 stocks of 201,915 long tons and 282,902 long tons on hand February 29, 1936.

Crude rubber afloat to U. S. ports as of February 28 is estimated to be 53,538 long tons which compares with 55,096 long tons afloat on January 31 and 46,532 long tons afloat on February 29 a year ago.

February reclaimed rubber consumption is estimated at 13,485 long tons; production, 15,192 long tons; and stocks on hand on February 28, 32,817 tons.

Names in the News

CHARLES A. FROELICH, formerly superintendent of the Pharis Tire and Rubber Company, Newark, Ohio, has joined the Armstrong Rubber Company, Inc., West Haven, Connecticut, as general manager.

J. J. BLANDIN, manager, Crude Rubber Division, Goodyear Tire and Rubber Company, Akron, who is credited with having laid out the company's rubber plantations in Sumatra in 1916, received his 25-year service pin last month.

FREDERICK A. CLARKE, sales manager, Forest City Rubber Company, Cleveland, Ohio, was married recently to MISS MARY ANN LEISTER, of Bloomville, Ohio. They will reside at 3094 Kensington Road, Cleveland Heights.

W. A. PATTERSON, formerly with G. L. Ohrstrom and Company, Inc., New York brokerage house, has joined the Pharis Tire and Rubber Company, Newark, Ohio, as sales manager. The Ohrstrom concern recently purchased a large block of Pharis stock.

H. J. ZIMMERMAN, traffic manager, B. F. Goodrich Company, Akron, Ohio, has been elected vice-president of the Great Lakes Regional Advisory Board. The Board is composed of transportation and industrial firm representatives in the Great Lakes area.

CHARLES K. NOVOTNY, recently returned from a one and a half year stay at the Liberian plantations of the Firestone Tire and Rubber Company, has rejoined the research department of that company in Akron.

RALPH H. NESMITH has been appointed assistant plant engineer of the Dayton Rubber Manufacturing Company, Dayton, Ohio. He was formerly connected with the Pharis Tire and Rubber Company.

PAUL DUNKEL, general manager of the Welland, Ontario (Canada) plant of the Joseph Stokes Rubber Company, is recuperating from a blood ailment which confined him to the Toronto General Hospital for some time.

DR. W. A. GIBBONS, director of research, U. S. Rubber Products, Inc., delivered an address on "Recent Progress in Rubber Technology" before a meeting of the Detroit Section of the A.S.T.M., held on April 7th at the Fort Shelby Hotel, in Detroit.

C. E. SULLIVAN has been appointed a vice-president of the Foxboro Company, Foxboro, Mass. He has been with the company for 26 years and has been sales manager since 1920.

F. A. STEELE, associated with the research division of the N. J. Zinc Company for the past seven years, recently resigned from that organization and has joined C. K. Williams & Company, Easton, Penna., as chief research chemist, replacing C. H. LOVE who has been placed in charge of the Technical Service Department, a new division.

JOHN S. KRAUSS, president, L. H. Gilmer Company, Philadelphia, Penna., was tendered a testimonial dinner at the Hotel Warwick, Philadelphia, last month, on the occasion of his twenty-fifth year of service with the company.

JAMES W. SCHADE, director of Research, B. F. Goodrich Company, Akron, Ohio, was scheduled to speak on "Rubber, a Versatile Servant" before the Science Forum of the New York Electrical Society, at a meeting to be held on April 14th in the Engineering Societies Building, New York City.

Buys Oak Hill Rubber Co.

W. A. Byrider, Jr., purchased the assets, properties and good-will of the Oak Hill Rubber Company, Oak Hill, Ohio, at a sheriff's sale held early last month. His bid of $8,000 was the only one made. The property was ordered sold when the company was unable to satisfy a judgment of $64,874 granted to Byrider recently on notes originally given to his father by the company and subsequently endorsed over to him. After the payment of taxes and court costs was deducted, the balance was applied to the judgment and a deficiency judgment for the balance granted by the court.

Change Rubber-Gel Name

The research and development laboratory of the Kaysam Corporation of America, formerly known as the Rubber-Gel Products Corporation, has been changed to the Kaysam Development Corporation. The change in name was effected to avoid confusion and to stamp the laboratory definitely as part of the Kaysam organization. The laboratory is maintained at North Adams, Mass.

Goodrich Raises Prices

For the second time this year, the B. F. Goodrich Company, Akron, raised its prices on all lines of mechanical rubber goods. The current increase calls for a 10% rise on all products, whereas the first increase, effective last January, called for increases ranging between 5 and 10%. Rising costs of raw materials and higher wages are responsible for the latest increase.

Goodyear Makes Changes

A number of executives have been advanced and others transferred to new posts by the Goodyear Tire and Rubber Company, Akron. At a meeting of the directorate held in Akron on March 29th, the following advancements were announced: E. J. Thomas, assistant to President Litchfield, to executive vice-president; P. E. H. Leroy, vice-president and treasurer, to vice-president in charge of finance, placing the comptroller's division under his supervision; and Z. C. Oseland, assistant treasurer, to treasurer.

E. J. Thomas
named executive vice-president

After graduating from Central High School, Mr. Thomas, a native Akronite, spent a short time at Akron University and joined Goodyear as a clerk in the chemical laboratory in 1919. Later he became secretary to Mr. Litchfield, head of the Flying Squadron, personnel manager, general superintendent of the California plant, managing director of the English branch, and last April returned to Akron as assistant to Mr. Litchfield. Mr. Leroy has been with Goodyear since 1929, while Mr. Oseland came to the company in 1929 after an extensive banking career.

Several changes in personnel affecting various Goodyear plants have also been announced. B. Darrow, development manager, has been shifted to California where he will act as Manager of Technical Service; W. S. Wolfe, assistant manager of truck tires, replaces Darrow as development manager at Akron; and Tommy Tomkinson, superintendent of Akron Plant 2, has been named General Superintendent.

Other changes include the following: D. E. Sheahan, general superintendent, Sydney, Australia, becomes superintendent of the new Jackson, Michigan, plant; Tom Clayton, head of the Flying Squadron, named assistant superintendent at Jackson; L. D. Hochberg, manager, engineering squadron, succeeds Clayton at Akron; Walter Condon, of England, replaces Sheahan at Australia; and C. W. Young appointed superintendent of the New Bedford, Mass., mills.

Financial News

OFFER 50,000 SHARES OF MARTIN TIRE STOCK

Gearhart and Lichtenstein, New York brokerage house, has placed on the market 50,000 shares of $5.00 par cumulative preferred stock of the Martin Custom Made Tires Corporation, with an annual dividend rate of 40 cents per share, payable quarterly. The purpose of the issue, according to the prospectus, is to furnish the Martin concern with the necessary funds to complete the equipping of the tire factory it recently purchased in Salem, Ohio; to pay off a $25,000 bank loan; and to pay various outstanding current obligations and trade acceptances for purchases of tires and tubes.

Representing a new company, re-incorporated in December, 1936, the Martin Custom Made Tires Corporation has a capitalization of $300,000 of $1.00 par value common stock and $1,000,000 of $5.00 8% cumulative preferred stock. At present only $200,000 of the common stock is outstanding, while the 50,000 shares of the preferred currently being offered represent the outstanding preferred.

The first "Martin Tire" was offered to the public in 1910 by James Martin, president of the new corporation, as well as of the predecessor companies. Up until the purchase of the Salem, Ohio, plant, these tires were manufactured by various tire manufacturers under private brand The Salem plant is being equipped to produce 300 tires per day, with provision made for increasing that figure to 700 per day if necessary. Capacity production at the factory is said to be 1,200 tires per day.

Columbian Profits Increase

A net income of $4,021,137, or $7.48 per share, for the year of 1936, has been reported by the Columbian Carbon Company, New York City, as compared with net income of $2,992,860, or $5.56 per share, in the preceding year. Of the 1936 profit, $687,812 was derived from interest and dividends, and $92,297 from non-recurring profit on the sale of securities. Total sales for 1936 amounted to $13,872,389 against $11,748,644 in 1935. Of this amount, 41.5% came from the sale of carbon black to the rubber, paint and other industries.

Goodyear Calls $7 Shares

Goodyear Tire and Rubber Company, Akron, has called for redemption on July 1st, 1937, all outstanding shares of its $7 second preferred stock, at $110 per share and accrued dividends. Redemption of these shares, which number approximately 11,000 and which represent less than 2% of the original issue, marks the completion of Goodyear's plan for rearrangement of its capital structure. Up until March 29th, a total of 747,739 shares, or more than 98%, had been exchanged for the new $5 convertible preferred and common stock under the terms of the plan. The exchange offer expired on March 13th.

Profit for Intercontinental

For the first time in several years, the Intercontinental Rubber Company, and subsidiaries, New York City, reported a profit for a calender year. For 1936 the company had a net income of $19,667, after Federal and foreign income taxes, equal to 3 cents on each of 595,832 no-par capital shares, including 428 shares to be issued under a current reorganization plan and excluding 172 shares in the treasury. In 1935, Intercontinental reported a net loss of $92,543.

Converse Plans New Issue

A plan to authorize a new issue of 17,742 special preferred shares entitled to 60 cents a share annually, has been presented to stockholders of the Converse Rubber Company, Malden, Mass. The company proposes to pay the present preferred dividend accumulations of $13 by a cash dividend of $3 and one share of special preferred stock, entitled to $10 a share and accrued dividends, upon liquidation.

Anaconda Doubles Income

For the year ended December 31st, 1936, the Anaconda Wire and Cable Company, and subsidiaries, reports a net income of $2,289,471, which is slightly double the $1,029,402 profit reported in the previous year. The 1936 profit is equivalent to $5.42 each on 421,981 shares as against $2.44 per share in 1935. Prior to deduction of expenses and charges, profit on manufacturing operations for 1936 amounted to $4,759,153, as compared with $2,942,125 in the preceding year.

American Cyanamid Profits

For the year of 1936 the American Cyanamid and Chemical Company, New York City, had a net profit of $4,454,930, equal to $1.77 each on the combined Class A and B common shares. This compares with a net profit of $4,062,160, or $1.61 a share, earned in the preceding year.

$64,482 Earned by National

National Rubber Machinery Company, Akron, reports a net profit of $64,482, equal to 47 cents each on 136,800 shares of capital stock, for the year of 1936. The company retains 17,200 shares of stock in its treasury. In 1935, National reported a net loss of $81,382.

HEWITT OFFERS SHARES; SHOWS PROFIT FOR 1936

The Hewitt Rubber Corporation, Buffalo, N. Y., through an underwriting group headed by F. Eberstadt and Company, Inc., New York City, recently offered 57,430 shares of common stock at $16.75 per share. Of these shares 52,000 represent additional new shares, from the proceeds of which Hewitt expects to redeem its outstanding funded debt, while the remaining shares represent a stock transfer, since they have been acquired from stockholders.

Upon completion of the offering and retirement of the funded debt, the capitalization of the company will consist solely of common stock, of which 168,188 shares will be outstanding.

For the year of 1936, Hewitt reports net earnings of $255,448, after all charges (including $16,750 provision for the Federal surtax on undistributed profits), which compares with a net profit of $162,865 in the preceding year. Prior to the recapitalization program, the company had 58,094 shares of $10 par value, which was outstanding at the end of 1935.

General Cable Seeks Loan

Stockholders of the General Cable Corporation approved the issuance of approximately $12,000,000 of new first-mortgage bonds and the retirement of $11,477,000 of 5½% Series A and B first-mortgage bonds, at the a nual meeting of the company held in New York City on March 17th. A registration statement covering the new bond issue is expected to be filed with the Securities and Exchange Commission shortly.

Profit for Kleinert

For the year of 1936, the I. B. Kleinert Rubber Company and domestic subsidiaries earned a net profit of $168,141, after provision for the Federal surtax on undistributed profits and other charges, equal to 98 cents a share on 170,515 shares of $10 par capital stock excluding 19,485 shares in the treasury. This compares with $158,958, or 92 cents a share on each of 171,515 shares in the preceding year.

Monsanto Increasing Stock

At a meeting held in St. Louis on March 23, stockholders of the Monsanto Chemical Company approved a plan to increase the authorized capital stock of the company to 2,000,000 shares, of which 275,000 shares will be no-par preferred and 1,725,000 shares will be no-par common stock. At present, Monsanto has 1,114,409 common shares outstanding.

Loss for Dunlop Tire

For the year ended December 31, 1936, the Dunlop Tire and Rubber Goods Company, Ltd., reports a net loss of $108,556, which compares with a net loss of $152,588 reported in the previous year.

BALDWIN APPEALS ROYALTY JUDGMENT

The Baldwin Rubber Company, Pontiac, Michigan, has filed an appeal from the royalty judgment awarded to the Paine and Williams Company, Cleveland, by Federal District Judge O'Brien, of Detroit, recently. The Cleveland concern was awarded $21,079, allegedly due in the form of royalties under a license agreement issued by that concern to Baldwin in 1932. The patents concerned in the original suit are those of Turner (U. S. P. 1,715,523) and Vrooman (U. S. P. 1,715,525).

At present, there is also pending an equity suit in the same Detroit court covering alleged infringement of the two patents for a period subsequent to that covered by the license agreement on which the courts have already awarded Paine and Williams a judgment. In addition, the company has also brought suit against Baldwin for alleged infringement of Design Patent 75,536.

A fourth suit, for royalties allegedly due under a license agreement covering contoured mats said to be covered by a patent application not yet issued, involving the same two principals, was heard by Judge O'Brien last month, but at this writing no decision has yet been rendered. A supplemental suit covering this same matter for an additional period of time not included in the previous suit has also been filed. The amount sought in these last two combined suits exceeds $100,000, according to E. E. Paine, president of the Paine & Williams Company.

LABORATORY VISITS INCLUDED IN TOUR

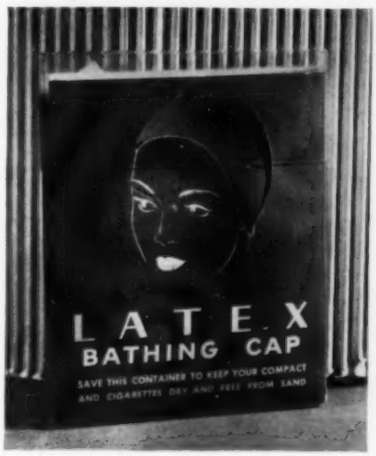
American industrialists will have an opportunity to observe developments in European rubber research this Summer during a tour of scientific laboratories being arranged by the Division of Engineering and Industrial Research of the National Research Council, 29 West 39th Street, New York City. The group will sail from New York on May 14th on the *S.S. Champlain*, according to present plans. Travel arrangements are being made by the American Express Company.

About one hundred prominent bankers and industrialists, including leaders in the rubber industry, are expected to participate in the tour which will enable them to visit such outstanding scientific laboratories as the Rubber Research laboratories in England, the Cavendish Laboratory at Cambridge, l'Ecole Nationale des Arts et Metiers, the Creusote Works in France, the Siemens Laboratories, and the Kaiser-Wilhelm Instituts of Germany.

Research laboratories of eighteen major fields of industry will be visited in England, France and Germany, besides those of trade associations, governments, and universities. In addition, accommodations will be made on the request of any member of the tour for special side trips to industrial laboratories not included in the general plans. Foreign hosts will be such organizations as the Department of Scientific and Industrial Research in England, the Verein Deutscher Ingenieure in Germany, the Sorbonne in France, and others.

Wins Packaging Award

A packaged latex bathing cap, merchandised by the Seamless Rubber Company, New Haven, Connecticut, took first honors in the most effective package insert classification of the 1937 Irwin D. Wolf Awards Competition for distinctive merit in packaging, sponsored by the American Management Association in connection with the annual packaging convention and exposition. The package, which was designed by Anderson, Davis and Platte, Inc., the company's advertising agency, also won honorable mention in the classification for the most effective package employing a secondary use. As may be noted from the illustration herewith, the package is composed of a one-color package insert which fits into a celluloid container, the rubber cap showing through a cut-out provided in the insert. The outer container may be used for keeping cigarettes and other items dry and free from sand, once the cap has been removed.



RUBBER IS FEATURED IN RADIO BROADCAST

Rubber was selected as the topic for a broadcast over the Columbia Broadcasting System coast-to-coast chain on March 20th as one of a series of the "Stories of Industry" sponsored by the CBS in cooperation with the Department of Commerce. The program was broadcast from Washington by Harry R. Daniel.

Describing the early use of rubber by natives in Central America and its subsequent adoption by the Spaniards and Portuguese, Mr. Daniels traced the history of rubber through Goodyear's discovery of vulcanization, the origin of the plantation rubber industry, development of rubber manufacturing in the United States, growth of Akron as a rubber manufacturing center, etc.

An index to Volumes 39 and 40 of THE RUBBER AGE will be found facing page 64 of this issue.

DeVILBISS EXPANDING ITS RUBBER DIVISION

The DeVilbiss Company, Toledo, Ohio, is expanding the activities of its rubber products division, operated as the Howard Manufacturing Company, a subsidiary, through the erection of a new factory in Toledo. The new plant will be 120 x 440 feet in size, of single story monitor type design and will have 55,000 square feet of floor space. It will cost approximately $250,000, including new equipment, according to Allen D. Gutchess, DeVilbiss president.

This is the third expansion move and the second factory required since DeVilbiss established its rubber products division in 1924. In 1928 the first factory was erected and as soon as the new plant is ready for occupancy this factory will be used to house one of the departments of the parent company now operating at capacity. The Howard concern was named after Howard DeVilbiss, son of Thomas A. DeVilbiss, for many years president of the company bearing his name.

The DeVilbiss concern manufactures atomizers and paint spray equipment for the most part, many of the rubber products manufactured by Howard being closely allied to these products, such as bulbs, tubing, all types of hose, etc. The rubber division, however, also produces other products, including gaskets and washers.

TIRE PRICES RAISED ANOTHER 6 PER CENT

Representing the fourth boost in the past nine months and the second this year, leading tire manufacturers advanced prices an average of 6% last month. This move places tire prices on a level of approximately 64.5% of the 1926 average and 64.4% of the 1929 average. As an example of the price rise, the Goodyear All-Weather tire was increased from $9.10 to $9.65.

This second increase has been expected since the first increase was made effective last January. Raising of wages from 5 to 8 cents an hour for tire workers, plus the continued rising market on crude rubber and cotton, led to the advance in prices. An additional increase is anticipated for the early future, probably on May 1st or June 1st, according to reliable sources of information.

Dayton Plans Warehouses

A construction program, which is estimated to cost $100,000, and which calls for the erection of two new warehouses as well as an addition to the present plant, is planned by the Dayton Rubber Manufacturing Company, Dayton, Ohio, according to John A. MacMillan, chairman of the board. The addition will be two stories in height, 140 x 100 feet, and is expected to relieve a crowded condition which exists in the conveyor belt department. The new warehouses will be 40 x 80 feet and 24 x 80 feet, respectively. All buildings will be of brick and steel.

Akron Briefs

Two new buildings, to cost around $65,000, are announced by the Columbia Alkali Corporation. Building permits were issued late in March by the city of Barberton, in which the plant is located, one for $35,000 and the other for $30,000. Both buildings will be of brick and steel construction. The $35,000 building will provide added facilities for the manufacture of chemicals and the $30,000 structure will provide added office space. Contracts have been awarded and construction will begin at once.

L. Albert & Son announce the purchase and liquidation of the rubber division of the Textilether Corporation of Toledo, Ohio. The purchase of this branch of the Toledo company in no way affects the textile business of that company, it was stated.

A new "Safety-Grip" tire with rib tread has been introduced by the Falls Rubber Company division of the Master Tire & Rubber Corporation. F. C. Millhoff, vice-president in charge of sales, said that the new product has been added to the Falls line after exhaustive laboratory and road tests.

J. P. Seiberling, vice-president in charge of sales of the Seiberling Rubber Company, is making a personal tour of inspection of business conditions relative o Seiberling tire sales and dealer activities in eastern states. J. H. Bunting, director of merchandising and advertising, and Col. J. L. Cocoran, sales manager, are looking over business conditions and future prospects in mid-western and western states.

Tire prices are due for another boost, along about May 1st, according to authoritative sources. This, if it arrives, will make the third price advance since the first of the year, and persons close to the industry who do not care to be quoted believe that other advances will come as the season advances—especially if cotton and rubber prices continue to advance and the present trend of high wages and salaries continues.

Persons in close touch with the conditions which have kept the Firestone plants closed and picketed for more than a month, do not believe that present difficulties will be ironed out until agreements are reached and strikes ended in the motor industry. Reports are that the Firestone tire inventories are 4,000,000 more than normal and that production has been stepped up in branch plants so that supplies to dealers have not been threatened with shortage and prospects for future delivery up to reasonable demand are not jeopardized.

Business is generally good among the smaller rubber companies in the Akron area, with minimum labor friction and prospects for future business promising. This is especially true of companies manufacturing novelties, toys, and sundries. With summer approaching, prospects for a record balloon business are unusually good, it is reported.

Arc Welding Contest

Described as "more truly a contest for engineers and designers of machinery than just an arc welding contest," the James F. Lincoln Arc Welding Contest has been announced, the total prizes offered amounting to $200,000. The purpose of the contest is to stimulate machinery engineers and designers and it is hoped will lead to accumulation of extensive and valuable data on machinery construction and design. It provides for 54 prizes in the industrial machinery classification alone, rubber manufacturing machinery, including calenders, dipping machines, platens, tire builders, etc., fitting into this category. Complete details of the contest are available from the James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio.

Hold International Congress

The International Congress of the International Association for Testing Materials is scheduled to open in London, England, on April 19th, and to continue until April 24th. Two papers of specific interest to the rubber industry are scheduled to be given, e.g., "Ageing of Vulcanized Rubber and Changes in Mechanical Properties," by B. D. Porritt and J. R. Scott, of the Research Association of British Rubber Manufacturers, Croydon, England, and "Accelerated Ageing Tests for Rubber, Paper and Weighted Silk," by Warren E. Emley, of the National Bureau of Standards, Washington, D. C. Abstracts of both of these papers will appear in the next issue of this journal.

Rocaguix Still Active

Despite the longevity of the Spanish difficulties, the firm of Rocaguix, manufacturers of rubber machinery, in Barcelona, is said to be producing machinery on a regular scale. According to advice from abroad, the war has interfered little with the company's activities. It is reported to be developing an electrical press which will be announced shortly.

Obituaries

Samuel W. Thompson

Samuel W. Thompson, president of Thompson, Weinman and Company, suppliers of clays and other materials to the rubber industry, died of pneumonia in the Fitch Sanitarium, New York City, on March 27th. He was 74 years of age. Mr. Thompson was born in Fitchville, Ohio, and entered the field of industrial chemicals shortly after receiving his education in local schools. Organizing Thompson, Weinman and Company many years ago, he watched the company develop to the point where today it operates mines at Cartersville and McIntyre, Georgia, Sparta, Tennessee, and Norristown, Pennsylvania. The company also maintains research laboratories at Cambridge, Mass. Headquarters are at 52 Vanderbilt Avenue, New York City. Mr. Thompson resided at 720 West End Avenue in New York City, and also maintained a Summer home at Bemis Point, Lake Chautauqua, New York. He leaves a widow and two daughters.

Nelson P. James

Nelson P. James, president, James Rubber Company, Boston, one of the best known mechanical rubber goods distributing firms in New England, died on March 21st after an operation performed at Philips House, Boston. He was 48 years old. A native of South Boston, Mr. James was graduated from English High School, Boston, and soon thereafter entered the rubber business. He is survived by his wife, whom he married a short time before his death, and two sons by a former marriage.

Carl F. Siemon

Carl Ferdinand Siemon, president of the Siemon Hard Rubber Company, Bridgeport, Connecticut, which he organized in 1903, died at the age of 67, at sea on March 16th aboard the *S.S. Exeter* of the American Export Line on which he and Mrs. Siemon were returning from a Mediterranean cruise. A native of Fort Wayne, Indiana, and a graduate of that city's public schools and the Concordia College of Indiana, Mr. Siemon entered the retail hardware business as a young man, becoming interested in the plastics field a few years later. Prior to moving to Bridgeport in 1903 and organizing the company which bears his name, Mr. Siemon spent five years with the Dickenson Hard Rubber Company, Springfield, Mass., as general manager. During the World War, he served as fuel administrator for Bridgeport. His interest in Republican activities led to his appointment as a member of the Bridgeport Board of Apportionment and Taxation at one time. Mr. Siemon was president of the Twilight Club, an organization of Masons past middle age; a past president of the Algonquin Club; and a member of the University, Elks and Brooklawn Country clubs.

LOS ANGELES NEWS

A new rubber products factory, known as the Arrowhead Rubber Company, with 8,000 square feet of floor space, has been established at 1976 Laura Street, Huntington Park (Los Angeles suburb), for the purpose of manufacturing rubber specialty items not now manufactured on the Pacific Coast. Production in the factory got under way March 15.

R. B. Stringfield has announced a twelve-weeks' course in rubber technology at the University of Southern California. The class will meet weekly and the thought is to interest as students, members of the Los Angeles Rubber Group. The nature of the course will be dictated by the class members to some extent and will either be strictly chemical or deal more specifically with practical phases of the industry.

Both general and private offices at the Kirkhill Rubber Company, 5801 S. Hoover Street, have been refinished. In an effort to meet the dust problem in an office located in a factory building the walls have been done in knotty pine and the floors covered with heavy linoleum.

Ironwear Rubber Products has moved its factory from 3838½ Van Ness Avenue, Los Angeles, to 6801 Compton Avenue, Huntington Park. The company, headed by George A. Lohrman, is specializing in oil field supplies and to some extent in plumbing specialties. On the same factory floor is the Granite Specialties Company, specializing in hospital supplies, notably in flask connectors, developments of E. G. House, the proprietor, who has done considerable work in the development of heat-resistant rubber compounds.

New Rubber Journal

The first rubber journal to be published in Italy has made its appearance. Called *"Gomma"*, it is being published bi-monthly by the firm of Pubblicita, Via Spuntini 5, Milan, under the direction of R. Ariano, noted Italian rubber technologist. The first issue, dated January-February, 1937, contains articles on Vulcanization by T. G. Levi, Hard Rubber by R. Ariano, Uses of Pneumatic Tires on Farm Equipment by the same author, and others, in addition to several articles reprinted from various rubber technical journals, including one on the Electrical Properties of Rubber, and another on Thiokol. Subscription rate for Italy and its colonies has been set at 25 Lire (approximately $1.30 at the current rate of exchange) and 40 Lire (approximately $2.20) for foreign countries. Single copies sell for 5 Lire (approximately 26 cents) each. This new journal, printed entirely in Italian, is a welcome addition to the list of international rubber periodicals.

Coming Events

April 19-24. Congress of the Int'l Ass'n of Testing Materials, London, England.

April 30. Chicago Group, Rubber Division, A.C.S., Hotel Sherman.

May 4. Los Angeles Group, Rubber Division, A.C.S., Hotel Mayfair, Los Angeles.

May 7. Boston Group, Rubber Division, A.C.S., Hotel Kenmore, Boston.

June 28-30. International Rubber Congress, Paris, France.

June 28-July 2. Annual Meeting, A.S.T.M. Hotel Waldorf-Astoria, New York City.

September 13-17. Rubber Division, A.C.S. Rochester, N. Y.

October 11-15. National Safety Council. (26th Safety Congress). Kansas City, Mo.

Dec. 5-11. Exposition of Chemical Industries, Grand Central Palace, New York City.

TIRE GUARANTEE PLAN RULED TO BE ILLEGAL

The practice of insuring tires against "any and all road hazards," generally referred to as the "road hazard guarantee," was held illegal in a ruling by Attorney General Herbert S. Duffy of Ohio made public on March 24th. Although practically all of the tire manufacturers voluntarily dropped this guarantee recently in favor of the standard warranty of the Rubber Manufacturers Association, the ruling was greeted with enthusiasm as a possible weapon in forcing large oil companies operating service stations and mail order organizations to likewise drop the guarantee.

According to Attorney General Duffy, the "road hazard guarantee" constitutes an insurance contract and tire dealers are not licensed to sell insurance. In general, he stated, warranties given by tire dealers against any damages other than ordinary road wear of tires are only "scraps of paper." The Ohio superintendent of insurance is believed to have prompted the move.

U. S. Dealer Magazine

Termed the *"Independent,"* the U. S. Tire Dealers Mutual Corporation, New York City, has started publication of a new monthly magazine devoted to the interests of independent tire dealers. The first issue, mailed several weeks ago, contains such articles as "How Service Makes Sales in an Oil Station" and "How the Farm Market Was Conquered."

TO OWNERS OF "LATEX IN INDUSTRY"

Copies of an addenda and errata list to Noble's "Latex in Industry" are available without cost by writing to THE RUBBER AGE, 250 West 57th Street, New York City.

TRENTON NEWS

The Joseph Stokes Rubber Company has let a contract for a one-story brick and steel factory addition. It will be 128 x 75 feet in dimension, and will cost approximately $40,000. Other factory expansions planned by Trenton rubber manufacturers include the following: The Thermoid Company will shortly erect a storehouse to replace the building recently destroyed by fire; Puritan and Whitehead Brothers contemplate new buildings; William R. Thropp Sons (manufacturers of rubber machinery) is erecting a new boiler house.

Vice Chancellor Berry has directed David M. Litwin, custodial receiver for the American Rubber Products Company, Hillside, N. J., to take charge of the assets of that company wherever they may be located. The order was granted on the petition of Morris L. Stepner and John H. Abrams, both of New Bedford, Mass., who claimed that Harry Friedman, of Hillside, had failed to live up to a partnership agreement to conduct a business under the name of the American Rubber Products Company in Boston, and also in New Jersey.

The American Hard Rubber Company, Butler, N. J., has entered into a wage agreement with the United Rubberworkers of America, providing increases of from 3 to 8% for the company's 700 employees. The agreement sets an hourly rate of 54 cents for men and 37 cents for women, the increases being 4 cents an hour and 2 cents an hour, respectively. Further wage adjustments are expected to be made in the Fall.

Automotive strikes current in the mid-West, particularly that of the Chrysler Corporation, have been felt to some extent in the Trenton area. Several plants engaged in the production of automotive rubber parts have been compelled to lay off employees. An active unionization campaign is also being waged in these rubber factories, despite Governor Hoffman's stand on sit-down procedure, although no such tactics have yet been employed.

Plan Summer Colloid Course

Under the direction of Dr. E. A. Hauser, the Massachusetts Institute of Technology, Cambridge, Mass., will give a special Summer program in Theoretical and Applied Colloid Chemistry. The course will run five weeks, beginning June 14, 1937, and will consist of lectures, round-table discussions and laboratory investigations. It is especially recommended to those actively engaged in industry or in research organizations. The first of these special courses was given last Summer.

ADVERTISING PAGES REMOVED

MARKETS

RUBBER—COTTON AND FABRICS—CHEMICALS

NEW YORK, APRIL 10, 1937

Crude Rubber

THE URGENT need for crude rubber by European countries in the race for war-time preparations, continued shortage for near deliveries, dealer buying for factory consumption, settlement of the Chrysler labor difficulty and the growing seriousness of the labor situation on rubber estates in the Far East, all combined to send crude rubber prices to the highest levels in more than eight years since our last report. A quotation of 26.81 was reached on the Commodity Exchange on April 1st. The lowest quotation on the Exchange since our last report was 23.12 on March 11th. A trend to the selling side by trade and speculative interests this past week, combined with the growing belief that the United States Government would attempt to check the rapid rise in commodity prices by revising the dollar price of gold, served to halt the upward swing. Since April 1st the price has fallen off approximately 250 points. World shipments of crude for March which totaled approximately 110,000 tons, representing the first month since December, 1934, that shipments exceeded consumption, also contributed to the declining market. Quotations in the outside market, Exchange, London and Singapore, follows:

As of April 10

Plantations—

Ribbed Smoked Sheets—			
No. 1 Spot	—	@	.24 7/16
April-June	—	@	.24 5/16
July-September	—	@	.24¼
No. 2	—	@	.24 3/16
No. 3	—	@	.24⅛
No. 4	—	@	.24 1/16
Thin Latex Crepe	—	@	.28
Thick Latex Crepe	—	@	.28
Brown Crepe, No. 1	—	@	.23 11/16
Brown Crepe, No. 2	—	@	.23 5/16
Amber Crepe, No. 2	—	@	.23 11/16
Amber Crepe, No. 3	—	@	.23 5/16
Amber Crepe, No. 4	—	@	.23 7/16
Brown Crepe, Rolled	—	@	.22 7/16

Latex—

Liquid Latex, per gal.	.82	@	.84

Paras—

Up-River, fine	—	@	.22¾
Acre Bolivian, fine	—	@	.23

Balata—

Block, Ciudad	—	@	.30

LONDON MARKET

Standard Smoked Sheets—Buyers—April 10

July-September	—	@	12 1/16d
October-December	—		12¼d

SINGAPORE MARKET

Standard Smoked Sheets—Sellers—April 10

July-September	—	@	12d
October-December	—	@	12d

Scrap Rubber

(Delivered Akron Mills)

With the unabated demand for supplies from reclaimers, scrap rubber prices have advanced on practically all grades other than boots and shoes and some tube stocks. Many dealers report difficulty in securing sufficient supplies to meet consumer demand. An active market is expected for some time. Current quotations follow:

(Prices to Consumers)

Auto tire peelings	ton 22.50	@	—
Mixed auto	ton 14.00	@	15.00
Beadless tires	ton 19.00	@	20.00
Clean solid truck tires	ton 28.00	@	30.00
Boots and shoes	ton 17.50	@	20.00
Arctics, untrimmed	ton 12.50	@	15.00
Inner tubes, No. 1	lb. .12	@	.13
Inner tubes, No. 2	lb. .06½	@	.06 5/16
Inner tubes, Red	lb. .06⅜	@	.06½

Reclaimed Rubber

The demand for reclaimed rubber shows no sign of curtailment with the result that practically every reclaimer is operating at capacity. The recent automotive labor difficulties apparently had no effect on the situation. Many reclaimers are completing plans for expansion of production facilities. Prices are nominal on all grades of reclaim with future prices highly unpredictable.

Shoe

Unwashed	lb.	.06¾ @	.07
Washed	lb.	.08¼ @	.07

Tube

No. 1 (Floating)	lb.	.19 @	.19¼
No. 2 (Compounded)	lb.	.08¾ @	.09
Red tube	lb.	.08¾ @	.09¼

Tires

Black (acid process)	lb.	.06¾ @	.07
Black, selected tires	lb.	.05¾ @	.06
Dark Gray	lb.	.08 @	.08½
White	lb.	.14 @	.14½
Truck, Heavy Gravity	lb.	.05¾ @	.06¾
Truck, Light Gravity	lb.	.06¼ @	.06½

Miscellaneous

Mechanical blends	lb.	.04¼ @	.04¾

Tire Fabrics

(Prices Net at the Mill)

Peeler, carded, 23/5/3	lb.	.37¼ @	.37½
Peeler, carded, 23/4/3	lb.	.38¼ @	.38½
Peeler, carded, 15/3/3	lb.	.35¼ @	.35½
Peeler, carded, 13/3/3	lb.	.34¼ @	.34½
Egyptian, carded, 23/5/3	lb.	.50 @	.50½
Egyptian, combed, 23/5/3	lb.	.55 @	.55½
CHAFERS			
Carded, American, 1 1/16"	lb.	.35½ @	.36½
Carded, American, 1"	lb.	.30½ @	.35

Sheetings

48x40	36 in.	5.50	lb.	— @	.07
40x40	36 in.	6.15	lb.	— @	.06 3/16
40x36	36 in.	6.50	lb.	— @	.06 1/16
48x48	40 in.	2.50	lb.	— @	.12 7/8
48x48	40 in.	2.85	lb.	— @	.12
56x60	40 in.	3.60	lb.	— @	.10¾
48x44	40 in.	3.75	lb.	— @	.09 5/8
44x40	40 in.	4.25	lb.	— @	.08¾

Ducks

Enameling (single filling)	lb.	.33 @	.35
Belting and Hose	lb.	.30 @	—
Single filling, A grade	lb.	.15½ @	.16½
Double filling	lb.	.16½ @	.17½

Cotton

Based on a rapidly improving supply and demand situation, largely the result of a tremendous increase in buying, cotton prices started an upward swing in mid-March, rising from a 14.05 quotation on March 8th to 15.00 on March 16th. Repeated warnings by Government officials, however, to the effect that the situation may get out of hand, thereby creating an unhealthy boom, served to stop the upswing and prices started on a downward march for the next several weeks. High consumption estimates and an intensification of the inflationary sentiment late in the month brought renewed confidence in the market and the price again passed the 15 cent mark. Continued Government objections, which tended to give rise to fears of drastic action, has checked buying and induced considerable speculative liquidation in the past few days, with the result that the price dropped to 14.53 today (April 10). In view of the fact that the N. Y. Cotton Exchange Service has just indicated that world consumption of all kinds will exceed production, the swing is again expected upward. Quotations for middling uplands on the N. Y. Cotton Exchange follow:

	March 9	April 10		
	Close	High	Low	Close
June	13.59	13.87	13.87	13.87
September	13.24	13.52	13.52	13.52
December	....	13.40	13.28	13.28

Closing Rubber Prices on New York Commodity Exchange, Inc.

No. 1 Standard Contract of 10 tons

FROM MARCH 10 TO APRIL 10

Date		Spot	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Sales
Mar.	10	23.47	23.48	23.53	23.58	23.64	23.70	23.75	23.80	23.83	23.83	23.84	23.85	23.85		773
	11	23.12	23.22	23.27	23.32	23.37	23.41	23.45	23.49	23.50	23.51	23.53	23.54	23.54		592
	12	23.35	23.42	23.47	23.52	23.62	23.72	23.72	23.73	23.76	23.78	23.80	23.81	23.81		472
	13	23.31	23.53	23.58	23.62	23.68	23.73	23.75	23.77	23.78	23.78	23.78	23.79	23.80		325
	14															
	15	23.41	23.50	23.53	23.55	23.58	23.61	23.65	23.67	23.68	23.67	23.65	23.65	23.65		382
	16	24.81	24.98	25.01	25.03	25.09	25.15	25.15	25.16	25.17	25.17	25.18	25.18	25.18		1286
	17	24.90	25.00	25.04	25.08	25.13	25.16	25.17	25.17	25.20	25.21	25.22	25.22	25.22		492
	18	25.32	25.45	25.47	25.49	25.49	25.50	25.50	25.50	25.51	25.51	25.50	25.51	25.51		801
	19	24.79	24.87	24.90	24.90	24.91	24.90	24.87	24.83	24.84	24.83	24.83	24.83	24.83		554
	20	24.63	24.63	24.65	24.66	24.67	24.66	24.67	24.67	24.66	24.66	24.68	24.68	24.68		328
	21															
	22	24.84	24.80	24.82	24.84	24.86	24.87	24.85	24.82	24.84	24.85	24.85	24.86	24.86		406
	23	24.75	24.80	24.82	24.84	24.85	24.85	24.86	24.87	24.83	24.83	24.84	24.85	24.85		369
	24	25.68	25.69	25.72	25.74	25.79	25.83	25.80	25.76	25.77	25.76	25.75	25.76	25.76		522
	25	25.97	25.99	26.01	26.03	26.07	26.10	26.09	26.08	26.05	26.03	26.00	26.01	26.01		777
	26															
	27	26.13	26.25	26.27	26.29	26.32	26.36	26.32	26.27	26.28	26.28	26.27	26.28	26.28		210
	28															
	29	26.60	——	26.66	26.68	26.74	26.80	26.81	26.80	26.80	26.79	26.78	26.79	26.79		621
	30	26.74	——	26.99	27.01	27.11	27.21	27.20	27.18	27.17	27.14	27.11	27.09	27.10		871
	31	25.60	——	26.70	26.66	26.67	26.68	26.67	26.65	26.65	26.64	26.63	26.63	26.63		891
Apr.	1	26.81	——	26.86	26.88	26.97	27.06	27.07	27.07	27.04	27.02	27.00	26.98	26.98	26.98	772
	2	26.44	——	26.49	26.51	26.60	26.69	26.69	26.70	26.68	26.66	26.63	26.63	26.61	26.58	774
	3	26.22	——	26.27	26.29	26.39	26.49	26.50	26.48	26.48	26.46	26.44	26.47	26.45	26.42	170
	4															
	5	25.78	——	25.88	25.90	25.99	26.08	26.09	26.10	26.05	26.04	26.03	25.98	25.94	25.90	474
	6	25.60	——	25.56	25.58	25.68	25.78	25.80	25.80	25.84	25.82	25.78	25.75	25.75	25.75	630
	7	24.38	——	24.33	24.35	24.46	24.57	24.57	24.56	24.53	24.52	24.50	24.47	24.45	24.42	1222
	8	24.65	——	24.72	24.74	24.82	24.89	24.92	24.95	24.90	24.90	24.90	24.87	24.85	24.82	659
	9	24.22	——	24.22	24.24	24.32	24.40	24.42	24.45	24.48	24.45	24.43	24.40	24.38	24.35	1162
	10	24.44	——	24.38	24.40	24.52	24.64	24.67	24.65	24.70	24.67	24.63	24.60	24.58	24.55	109

Rubber CHEMICAL Markets

NEW YORK, APRIL 13, 1937

[All Quotations F.O.B. Works Unless Otherwise Noted]

ACCELERATORS

Organic			
A-1 (Thiocarbanilid)	lb.	.24 @	.28
A-5-10	lb.	.33 @	.36
A-7	lb.	.53 @	.65
A-11	lb.	.60 @	.75
A-16	lb.	.55 @	.65
A-19	lb.	.56 @	.75
A-32	lb.	.70 @	.80
A-77	lb.	— @	—
Aldehyde ammonia, crystals	lb.	.65 @	.70
Altax	lb.	— @	—
Captax	lb.		
Crylene	lb.	.55 @	.65
paste	lb.	.45 @	.55
Di-Ortho-Tolyguanidine	lb.	.44 @	.47
Diphenylguanidine	lb.	.35 @	.37
El-Sixty	lb.	.55 @	.65
Ethylidene aniline	lb.	.45 @	.47½
Formaldehyde aniline	lb.	.37½ @	.42
Guantal	lb.	.42 @	.51
Heptene	lb.	.40 @	—
Hexamethylene-tetramine	lb.	.37 @	—
Lead Oleate, No. 999	lb.	.12 @	—
Witco	lb.	.12 @	—
Lithex	lb.	.18 @	.20
Methylenedianiline	lb.	.36 @	.37
Monex	lb.	3.25 @	—
Oxynone	lb.	.68 @	.80
Phenex	lb.	.50 @	.55
Pipsolene	lb.	1.60 @	1.85
R & H 40	lb.	.40 @	.41
R & H 50	lb.	.40 @	.41
R-2	lb.	1.50 @	1.80
Safex	lb.	1.20 @	1.25
SPDX	lb.	.75 @	—
Super-Sulphur No. 1	lb.		
No. 2	lb.		
Thiocarbanilid, drums	lb.	.24 @	.28
Trimene	lb.	.75 @	—
base	lb.	1.20 @	—
Triphenylguanidine	lb.	.58 @	.60
Tuads	lb.		
Ureka	lb.	.62 @	1.00
Ureka B	lb.	.62 @	.75
Ureka C	lb.	.58 @	.69
Vulcanex	lb.		
Vulcone	lb.		
Vulcanol	lb.		
Z-88-P	lb.	.48 @	.60
Zimate	lb.		
Inorganic			
Litharge, domestic	lb.	.07½ @	.08½
Magnesia, calcined, heavy	lb.	.04 @	—

COLORS

Blacks (See Compounding Materials)			
Blues			
Prussian	lb.	.37 @	.39
Ultramarine	lb.	.15 @	—
Browns			
Sienna, Italian	lb.	.06 @	'13
Umber, Turkey	lb	.04 @	.04½
Greens			
Chrome, light	lb.	.20 @	.30
medium	lb.	.21 @	.31
Chromium Oxide, bbl.	lb.	.19 @	.20
Guignet's Green	lb.	.70 @	—
Reds			
Antimony			
crimson, 15/17	lb.	.48 @	—
sulfur, free	lb.	.48 @	.60
Indian English	lb.	.09 @	.10
Domestic (Maroon)	lb.	.11 @	—
Red oxide, pure	lb.	.10 @	.12
Rub-Er-Red, f.o.b. Easton	lb.	.09¼ @	—
Whites			
Cryptone CB, No. 21	lb.	.05¾ @	.06
Cryptone, No. 19	lb.	.05¾ @	.06
Cryptone, ZS-20	lb.	.09 @	.09¼
Cryptone, ZS-86	lb.	.09 @	.09¼
Lithopone			
Albalith, black label—11	lb.	.04¼ @	.04½
Azolith	lb.	.04¼ @	.04½
Rayox	lb.		
Titanox A	lb.	.16 @	.16¾
Titanox B	lb.	.05¾ @	.06
Titanox C	lb.	.05¾ @	.06
Zinc Oxide—American Process			
American Azo:			
ZZZ (lead free)	lb.	.05¼ @	.05½
Anaconda, lead free	lb.	.05¼ @	.05½
Horsehead Lead Free Brand:			
Special—3	lb.	.05¼ @	.05½
XX Red—4	lb.	.05¼ @	.05½
XX Red—72	lb.	.05¼ @	.05½
XX Red—78		.05¼ @	.05½
XX Red—103	lb.	.05¼ @	.05½
U. S. P.—7, bbls.	lb.	.05¼ @	.05½
Kadox, black label—15	lb.	.05¼ @	.05½
Blue label—16	lb.	.05¼ @	.05½
Red label—17	lb.	.05¼ @	.05½
St. Joe, black label	lb.	.05¼ @	.05½
green label	lb.	.05¼ @	.05½
red label	lb.	.05¼ @	.05½
Zinc Oxide—French Process			
Florence White seal—7 bbls.	lb.	.06¾ @	.07
Green seal—8	lb.	.06¼ @	.06½
Red seal—9	lb.	.05¾ @	.06
Yellows			
Chrome	lb.	.11 @	.12
Ocher, dom. med.	lb.	.02¾ @	—

BLACKS

Arrow "Aerfloted" Specification	lb.	.0535 @	.0825
Bone, powdered	lb.	.05½ @	.12½
Carbon, compressed	lb.	.0535 @	.0825
uncompressed	lb.	.0535 @	.0825
"Certified," Cabot	lb.	.0535 @	.0825
Spherons	lb.	.0535 @	.0825
"Disperso"	lb.	.0535 @	.0825
Drop, bbls.	lb.	.05½ @	.14
"Excello," compressed	lb.	.0535 @	.0825
"Fumonex"	lb.	.03 @	.07
"Gastex"	lb.	.03 @	.07
Lampblack	lb.	.07 @	.12
"Micronex"	lb.	.0535 @	.0825
"Supreme"	lb.	.0535 @	.0825
Thermatomic—"P 33"	lb.	— @	—
"Thermax"	lb.	— @	—
United "Dixie" & "Kosmos"	lb.	.0535 @	.0825

COMPOUNDING MATERIALS

Aluminum Flake	ton.	21.85 @	24.50
Ammonia carbonate, lump	lb.	.10½ @	.12
Asbestine	ton	13.00 @	15.00
Barium carbonate (98-100%)	ton	56.50 @	61.50
Barium Dust	lb.	.05 @	.06
Barytes	ton	23.65 @	31.15
Basofor	lb.	.04½ @	—
Bentonite	lb.	.02 @	.03
Blanc fixe dry f.o.b. works	ton	70.00 @	75.00
Calcene	ton	37.50 @	45.00
Catalpo (fact.)	lb.	.02 @	—
Chalk, precipitated			
Suprex white, extra lt.	ton	45.40 @	60.00
heavy	ton	45.00 @	55.00
Clay, Kaolin, domestic	ton	7.50 @	15.00
Aerfloted, Suprex	ton	8.50 @	10.00
Congaree	ton	9.00 @	—
Dixie	ton		
Dixie, Jr.	ton		
McNamee	ton		
Par	ton		
Tensulite		15.00 @	—
Witco	ton	8.50 @	9.00
Cotton Flock	lb.	.11 @	.15
Glues, extra white	lb.	.28 @	.30
medium white	lb.	.14 @	.19
Kalite No. 1	ton	30.00 @	55.00
Kalite No. 3	ton	40.00 @	65.00
"Lime Crest" Industrial Filler No. 100	lb.	— @	—
Magnesium carbonate	lb.	.08 @	—
Mica	ton	35.00 @	—
Pyrax A	ton	— @	—
Rottenstone (powdered)	lb.	.02½ @	.05
Soapstone, powdered	ton	16.00 @	22.00
Starch, powdered	cwt.	2.90 @	4.10
Talc, domestic	ton	16.00 @	18.00
Whiting, commercial	ton	17.00 @	18.00
Columbia Filler	ton	9.00 @	14.00
English Cliffstone	ton	33.00 @	43.00
Witco	ton	7.00 @	—
Wood Flour	ton	18.00 @	30.00
Zinc Carbonate	lb.	.10½ @	.11
Zinc Stearate	lb.	.27 @	—

MINERAL RUBBER

Black Diamond	ton	27.00 @	—
Genasco, solid (factory)	ton	25.00 @	27.00
Hard Hydrocarbon	ton		
Parmr, solid	ton	25.00 @	—
Pioneer, MR, solid	ton		
Pioneer-granulated	ton		

SPECIALTIES

Aromatics—Rodo	lb.		
Para-Dors No. 5145	lb.	2.00 @	—
Sunproof	lb.	.35 @	.37½
Sponge Paste	lb.	— @	.80
Tonox	lb.	.56 @	.60

SOFTENERS

Acids			
Acetic, 28%, bbls.	100 lb.	2.45 @	2.70
Nitric, 36 degrees	cwt.	5.00 @	6.00
Sulfuric, 66 degrees	ton	15.50 @	16.50
Acids, Fatty			
Laurex	lb.	.15 @	.16
Stearex Beads	lb.	.10½ @	.11
Stearic, double pressed	lb.	.11½ @	.12½
Stearite	lb.	.10½ @	.11½
Alkalies			
Caustic Soda, 76%	cwt.	3.05 @	—
Soda Ash, 58% C.L.	cwt.	1.25 @	—

Oils			
Corn, refined, bbls.	lb.	.12¾ @	—
Cottonseed, crude	gal.	.095 @	.10
Cycline Oil	gal.	.15 @	.28
Degras, bbls.	lb.	.07¾ @	.08
Fluxrite	lb.	.05½ @	.06½
Palm Lagos	lb.	.06 @	—
Niger	lb.	.06½ @	.06¾
Para-Flux	gal.	.17 @	—
Petrolatum, light	lb.	.03½ @	.03¾
Pigmentaroil, tank cars	gal.	.16 @	—
in drums	gal.	.22½ @	.23½
Pine, steam distilled	gal.	.64 @	.65
dest. dist., drums	gal.	.44 @	.46
Rosin Oil, cmpd		40 @	
Rubtack	lb.	.08 @	.10
Seedine, c.l.	lb.	.07½ @	—
Tackol	lb.	.08½ @	.18
Witco Palm Oil	lb.	.07 @	—
Witco Softener	gal.	.18 @	—
Woburn No. 8, c.l.	lb.	.06 @	—
Wobonite, c.l.	lb.	.05 @	—
Resins and Pitches			
Pitch, Burgundy	lb.	.04 @	.06
coal tar	gal.	.07½ @	.08
hardwood	ton	15.00 @	—
pine, 200 lb. gr. wt.	bbl.	5.00 @	5.25
Rosin, grade K, 280 lb.	bbl.	10.95 @	—
Pigmentar, tank cars	gal.	.16 @	—
in drums	gal.	.22½ @	.23½
R. S. L. Resin	lb.	— @	—
Retort Pine Tar, drums	bbl.	11.50 @	12.50
Solvents			
Acetone, pure	lb.	.06 @	—
Alcohol, denatured, methanol, No. 1 bbls.	gal.	.28 @	.39
Benzene, 90%	gal.	.18 @	.23
Beta-Trichlorethane	gal.	— @	—
Bondogen	lb.	— @	—
Carbon, bisulfide	lb.	.05¼ @	.08
Carbon, tetrachloride	lb.	.05¾ @	—
Dichlorethylene	lb.	.29 @	—
Dipentene, cml., drums	gal.	.41 @	.43
Dryolene (f.o.b. Okla.)	gal.	.10 @	.10½
Ethylene dichloride	lb.	.05½ @	.06½
Gasoline, steel bbls.	gal.	.16 @	—
Naphtha, solvent	gal.	.31 @	—
Plastogen	lb.		
Reogen	lb.		
Rub-Sol (f.o.b. Okla.)	gal.	.09 @	—
Trichlorethylene	lb.	— @	.09½
Turpentine, spirits	gal.	.50 @	—
dest. dist., drums	gal.	.38 @	.40
Waxes			
Beeswax, white	lb.	.38 @	.40
Carnauba, yellow	lb.	.46 @	.47½
Ceresin, white, dom.	lb.	.08 @	.11
Montan, crude	lb.	.10¾ @	.11¾
Paraffin (c.l.—f.o.b. N. Y.)			
Yellow crude scale	lb.	.03½ @	—
White crude scale 124/126	lb.	.03 @	—
Refined, 122/127	lb.	.04½ @	—

ANTI-OXIDANTS

AgeRite, Gel	lb.		
HP	lb.		
Powder	lb.		
Resin	lb.		
White	lb.		
Albasan	lb.	.70 @	.75
Antox	lb.		
B-L-E	lb.	.57 @	.60
Flectol-H	lb.	.54 @	.65
Flectol White	lb.	.95 @	1.15
Flectol B	lb.	.54 @	.65
Neozone	lb.		
Oxynone	lb.	.66 @	.75
Perfectol	lb.	.67 @	.75
Retardex	lb.	.35 @	.40
Santoflex A	lb.	— @	—
Stabilite	lb.	.57 @	.62
Stabilite Alba	lb.	.70 @	.75
VGB	lb.	.55 @	.60

MOLD LUBRICANTS

Aresklene	lb.	— @	—
Cocoa Soapstock	lb.	.06 @	.08
Dipex	lb.	.06 @	.08
Lubrex	lb.	.25 @	.30
Rusco, f.o.b. Nitro	lb.	.12 @	.30
Sericite, f.o.b. N. Y.	ton	65.00 @	—
Soap Tree Bark, cut, sifted	lb.	.06 @	.08

FACTICE OR RUBBER SUBSTITUTES

Amberex	lb.	.23 @	—
Black	lb.	.08½ @	—
White	lb.	.095 @	.15
Brown	lb.	.095 @	.14
Neophax	lb.	.13 @	—

VULCANIZING INGREDIENTS

Sulfur Chloride, yellow (drs.)	lb.	.03½ @	.04½
Sulfur flour,			
Refined, 100% pure (bags)	cwt.	2.55 @	3.15
Commercial (bags)	cwt.	1.60 @	2.35
Telloy			
Vandex	lb.		

Crude Rubber
Latex and Guayule
Reclaimed Rubber
Tires and Tubes

STATISTICS OF THE INDUSTRY

Rim Production
Automobiles
Gasoline
Cotton Prices

U. S. Imports and Exports of Crude Rubber

YEARS	Gross Imports: Long Tons	Total Declared Value	Average Declared Value per pound Cents	Re-exports: Long Tons	Total Declared Value	Average Declared Value per pound Cents	Net Imports: Long Tons
1922	301,076	101,843,188	15.10	4,809	1,921,828	17.84	296,267
1923	309,362	185,060,304	26.71	8,772	5,672,319	28.87	300,590
1924	325,899	173,367,272	23.75	10,309	6,057,637	26.23	315,590
1925	393,370	426,167,504	48.36	14,827	19,847,753	59.76	378,543
1926	409,944	501,131,064	54.57	17,671	22,470,583	56.77	392,273
1927	424,733	338,688,492	35.60	27,775	24,735,488	39.76	396,958
1928	432,633	242,727,423	25.05	32,159	18,128,761	25.17	400,474
1929	560,082	239,177,811	19.06	36,485	16,868,718	20.64	523,597
1930	482,083	139,133,048	12.88	30,205	9,310,205	13.76	451,878
1931	497,176	72,922,845	6.55	25,595	4,255,572	7.42	471,581
1932	409,556	31,936,459	3.48	20,930	2,015,612	4.30	388,626
1933	407,817	44,034,064	4.82	20,537	2,601,352	5.65	387,280
1934	449,513	97,929,676	9.73	23,848	5,770,109	10.80	425,665
1935	453,134	115,299,448	11.36	11,389	3,084,331	12.09	441,745
1936	467,064	152,072,496	14.54	12,581	4,488,223	15.93	454,483
1935:							
July	46,987	11,666,577	11.08	489	132,153	12.06	46,498
August*	40,275	10,422,625	11.55	476	130,464	12.23	39,799
Sept.	34,659	8,637,048	11.12	468	120,438	11.48	34,191
Oct.	35,091	8,742,222	11.12	651	188,518	12.92	34,440
Nov.*	25,155	6,164,454	10.94	380	101,793	11.95	24,775
Dec.	38,417	9,930,710	11.54	1,821	523,997	12.85	36,596
1936:							
Jan.*	32,310	8,637,997	11.94	733	229,129	13.98	31,577
Feb.	32,879	9,293,711	12.62	625	199,956	14.27	32,254
Mar.*	33,447	9,845,776	13.14	1,172	390,551	14.88	32,275
Apr.*	44,218	13,967,712	14.10	984	343,785	15.59	43,234
May*	35,578	11,460,157	14.38	1,589	580,021	16.30	33,989
June	36,376	12,073,632	14.82	2,469	904,669	16.35	33,907
July	38,178	12,763,200	14.92	1,383	510,075	16.47	36,795
Aug.	40,027	13,364,916	14.91	840	307,114	16.32	39,187
Sept.*	48,368	16,691,919	15.41	656	244,554	16.64	47,712
Oct.	39,573	13,627,465	15.37	778	268,645	15.42	38,795
Nov.*	36,798	12,790,306	15.52	675	241,982	15.99	36,123
Dec.	49,312	17,555,705	15.89	677	267,745	17.65	48,635
1937:							
Jan.	42,002	15,408,242	16.38	844	372,053	19.69	41,158
Feb.	42,743	16,470,867	17.20	523	236,853	20.21	42,220

* Revised.

Note: Annual figures for 1922-1936 revised on basis of information received on February 8, 1937. Figures for 1922 and 1923 include latex; guayule is included only in 1922.

United States Imports of Guayule, Balata, Jelutong, Liquid Latex

(All Quantities in Long Tons)

	Guayule Tons	Guayule Dollars	Balata Tons	Balata Dollars	Jelutong Tons	Jelutong Dollars	Liquid Latex (1) Tons	Liquid Latex (1) Dollars
1924	1,356	536,392	464	568,456	6,165	1,237,100	2,157	864,059
1925	3,781	1,803,448	517	574,750	6,749	1,642,531	3,272	3,537,510
1926	4,305	2,562,096	354	327,213	7,263	3,127,757	3,394	4,686,743
1927	5,018	2,674,957	582	477,246	7,785	2,448,657	1,495	1,170,650
1928	3,077	1,755,685	731	430,855	7,552	2,540,059	4,007	2,121,786
1929	1,275	545,175	728	566,964	8,204	2,458,126	3,729	1,788,391
1930	1,096	347,388	502	422,684	5,907	1,403,244	4,458	1,508,786
1931	.....	.....	1,207	411,380	5,777	1,019,010	4,675	888,909
1932	.....	.....	707	147,403	4,607	616,596	5,112	601,999
1933	.....	.....	1,659	2,261,869	5,990	944,895	11,085	1,833,671
1934	398	75,349	1,054	438,209	4,987	943,752	13,107	3,643,221
1935	459	86,835	615	188,384	5,644	1,063,126	13,553	3,782,222
1936	1,229	286,552	535	199,368	6,163	1,296,364	19,852	6,659,899
1936:								
May	88	16,698	59	21,217	521	114,099	1,472	490,769
June	97	18,380	33	13,671	767	186,274	1,897	657,311
July	96	18,168	44	15,314	556	106,676	1,665	579,895
Aug.	146	37,147	72	23,715	321	64,769	1,761	602,992
Sept.	106	29,335	21	9,846	418	85,624	1,800	692,810
Oct.	114	31,489	11	4,815	452	102,485	1,392	500,817
Nov.	159	43,980	43	19,408	405	91,538	1,631	578,729
Dec.	134	36,972	14	7,247	538	109,208	2,070	735,156
1937:								
Jan.	160	44,166	10	4,348	247	56,056	1,337	535,546
Feb.	206	56,807	14	5,838	242	61,741	1,973	775,202

(1) Weight given in pounds of dry rubber contained in latex.

Note: Annual figures for 1924-1936 revised on basis of information received on February 8, 1937.

U. S. Consumption of Crude Rubber

(Rubber Manufacturers' Association statistics raised to 100 per cent—All figures in long tons)
(All Quantities in Long Tons)

Figures on Monthly Basis

	1930	1931	1932	1933	1934	1935	1936	1937
Jan.	36,194	28,557	29,648	22,645*	39,190*	46,636*	48,506	48,744
Feb.	33,302	28,797	31,821	21,392*	40,515*	42,720*	36,746	50,282
Mar.	35,540	32,788	29,505	17,483*	47,003*	42,153*	42,703	.....
Apr.	39,686	33,321	27,518	25,928	44,853*	44,247*	51,897	.....
May	39,386	37,817	30,957	44,074	42,918*	41,101*	50,482	.....
June	34,195	37,916	41,475	50,743*	40,147*	36,156*	52,636	.....
July	29,508	31,397	29,976	49,614*	32,553*	35,917*	48,127	.....
Aug.	30,850	27,586	23,721	44,428*	33,216*	38,775*	46,657	.....
Sept.	25,515	23,638	23,847	35,281*	30,258*	37,086*	46,330	.....
Oct.	27,516	22,277	22,286	31,543*	31,253*	41,969*	49,509	.....
Nov.	23,691	22,943	23,231	28,831*	34,748*	42,310*	50,303	.....
Dec.	21,687	21,409	18,015	28,757*	36,569*	42,474*	49,626	.....
Tot.	375,980	348,986	332,000	400,719*	453,223*	491,544*	573,522	.....

* Revised.

Reclaimed Rubber in the United States

(All Quantities in Long Tons)

Year	Production	Consumption	% to Crude	Stocks*	Year	Production	Consumption	% to Crude	Stocks*
1927	189,144	178,471	47.6	24,980	1932	75,608	77,504	23.4	16,354
1928	208,516	223,000	50.4	24,785	1933	99,560	81,602	19.9	20,746
1929	218,954	226,589	48.4	27,464	1934	110,010	100,597	22.2	23,079
1930	157,967	153,497	40.8	22,001	1935	122,948	113,078*	23.0a	25,069
1931	133,351	124,126	33.9	19,257	1936	150,571	130,048	22.7	30,573

Figures on Monthly Basis

	Production	Consumption	% to Crude	Stocks*		Production	Consumption	% to Crude	Stocks*
1936:									
Jan.	11,665	10,039	20.7	26,145	July	12,330	11,816	24.6	22,602
Feb.	10,188	7,366	20.1	28,267	Aug.	12,856	10,993	23.6	23,750
Mar.	10,712	8,767	20.5	29,161	Sept.	12,959	11,170	24.1	24,950
April	11,382	10,333	19.9	22,274	Oct.	14,737	12,606	25.7	26,389
May	11,512	10,398	20.6	22,852	Nov.	14,357	12,029	23.8	28,135
June	11,935	11,547	21.9	22,738	Dec.	15,938	12,984	26.2	30,573
1937:									
Jan.	15,129	13,366	27.5	31,610	July	.....	.....	...	.....
Feb.	15,192	13,485	26.8	32,817	Aug.	.....	.....	...	.....
Mar.	.....	.....	...	.....	Sept.	.....	.....	...	.....
April	.....	.....	...	.....	Oct.	.....	.....	...	.....
May	.....	.....	...	.....	Nov.	.....	.....	...	.....
June	.....	.....	...	.....	Dec.	.....	.....	...	.....

* Stocks on hand at the end of month or year.
a Revised.

U. S. Consumption of Gasoline

(Bureau of Mines Statistics)
(In Thousands of Barrels of 42 Gallons)

	1935	1936	1937		1935	1936	1937
January	28,147*	32,412*	33,696	August	43,097*	46,081	.....
February	26,580*	27,216*	32,000	September	37,976*	44,346	.....
March	32,272*	35,871	.....	October	41,566*	44,253	.....
April	36,363*	38,825	.....	November	35,991*	39,919	.....
May	39,381*	42,007	.....	December	33,872*	39,393	.....
June	38,086*	44,630	.....				
July	41,479*	46,638*	.....	Total	434,810*	481,591	.....

* Revised.

Rims Inspected and Passed in U. S.

(Tire and Rim Association Reports)

	Total		Total		Total
1925	26,001,664	1929	24,141,502	1933	8,713,962
1926	24,199,524	1930	17,364,006	1934	12,255,118
1927	19,700,003	1931	11,253,800	1935	18,664,356
1928	24,247,282	1932	6,261,336	1936	20,790,098

1937:		1937:		1937:	
January ...	2,123,723	May	.....	September ..	.....
February ..	2,022,258	June	.....	October ...	.....
March	2,166,218	July	.....	November ..	.....
April	.....	August	.....	December ..	.....

Daily Spot Closing Prices of Ribbed Smoked Sheet Rubber—*New York Market, in Cents per Pound*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Ave.
1935																																
January		13½		13½			13¾	13¾	13¾	13¾				13¼	12⅞	13⅛		13	13	13⅜	13	12⅛	12⅛	12⅜	12⅜	12⅜		12½	12⅜			13⅛
February		13¼		13¼	13½		13¾	13¾	13⅞		13			13	13	12⅞		13⅛		13⅜	13⅛			12⅜	12⅜	12⅜		12⅜	12⅜			12⅞
March		12⅜		12⅜	12¾		12⅞	12⅞	12⅞		11⅝			11⅝	12⅛	12⅛		12⅛		12⅜	11⅞			11⅞	11⅞	11⅞		11⅞	11⅞			12
April		11⅜		11⅜	11⅝		11⅝	10⅞			11⅜	11⅜		11⅜	11	11⅛		11⅛		10⅝	10⅝			10⅝	10⅝	11⅛		11⅛	11⅛			11½
May		11⅝		11½	12½		12⅛	11⅝			11⅛	11⅛		11⅛	11⅛	11⅛		11⅛		11⅛	11⅛			11⅛	11⅛	11⅛		11⅛	11⅛			11½
June		12⅛					12⅛	12⅛	12⅛		12⅛	12⅛		12⅛	12⅛	12⅛		12⅛		12⅛	12⅛			12⅛	12⅛	12⅜		12⅜	12⅜			12
July		12⅛		12⅛	12½		12⅝	12⅝	12⅝		12⅝	12⅝		12⅝	12⅝	12⅝		12⅝		12⅝	12⅝			12⅝	12⅝	12⅝		12⅝	12⅝			12⅛
August		12⅛					12⅝	12⅝	12⅝		12⅝	12⅝		12⅝	12⅝	12⅝		12⅝		12⅝	12⅝			12⅝	12⅝	12⅝		12⅝	12⅝			12⅛
September		11⅜		11⅜	11⅝		11⅝	11⅝	11⅝		11⅝	11⅝		11⅝	11⅝	11⅝		11⅝		11⅝	11⅝			11⅝	11⅝	11⅝		11⅝	11⅝			11⅝
October		11⅜		11⅜	11⅝		11⅝	11⅝	11⅝		11⅝	11⅝		11⅝	11⅝	11⅝		11⅝		11⅝	11⅝			11⅝	11⅝	11⅝		11⅝	11⅝			11⅝
November		13⅛		13⅛	13⅜		13⅜	13⅜	13⅜		13⅜	13⅜		13⅜	13⅜	13⅜		13⅜		13⅜	13⅜			13⅜	13⅜	13⅜		13⅜	13⅜			13⅜
December		13⅛		12⅜	13		13⅛		13		13	13		13	13	13⅛		13⅛		13⅛	13⅛			13⅛	13⅛	13⅛		13⅛	13⅛			13⅛
1936																																
January		13½		13⅜		13⅜	13⅛		13⅜	14	14⅛		14⅛	14⅛	14⅛	14⅛	14⅛	14⅛		14⅜	14½			14⅜	14⅜	14⅜		14⅜	14⅜			14½
February		15⅛		15⅛	15⅛	15⅛	15⅞		13⅜	15⅛	15⅛		15⅛	15⅛	15⅛	15⅛	15⅛	15⅛		15⅛	15⅛			15⅛	15⅛	15⅛		15⅛	15⅛			15½
March		15⅝		15⅝	15⅝	15⅝	15⅝		15⅝	16	15⅝		16	16	16	16	16	16		16	15⅞			16	16	16		16	16			16
April		15⅝		15⅝	15⅝	15⅝	15⅝		15⅝	15⅝	15⅝		15⅝	15⅝	15⅝	15⅝	15⅝	15⅝		15⅝	15⅝			15⅝	15⅝	15⅝		15⅝	15⅝			15⅝
May		15⅝		15⅝	15⅝	15⅝	15⅝		15⅝	15⅝	15⅝		15⅝	15⅝	15⅝	15⅝	15⅝	15⅝		15⅝	15⅝			15⅝	15⅝	15⅝		15⅝	15⅝			15⅝
June		15⅝		15⅝	15⅝	15⅝	15⅝		15⅝	15⅝	15⅝		15⅝	15⅝	15⅝	15⅝	15⅝	15⅝		15⅝	15⅝			15⅝	15⅝	15⅝		15⅝	15⅝			15⅝
July		16⅛		16⅛	16⅛	16⅛	16⅛		16⅛	16⅛	16⅛		16⅛	16⅛	16⅛	16⅛	16⅛	16⅛		16⅛	16⅛			16⅛	16⅛	16⅛		16⅛	16⅛			16⅛
Aug.					16⅛	16⅛	16⅛		16⅛	16⅛	16⅛		16⅛	16⅛	16⅛	16⅛	16⅛	16⅛		16⅛	16⅛			16⅛	16⅛	16⅛		16⅛	16⅛			16⅛
Sept.		16⅝		16⅝	16⅝	16⅝	16⅝		16⅝	16⅝	16⅝		16⅝	16⅝	16⅝	16⅝	16⅝	16⅝		16⅝	16⅝			16⅝	16⅝	16⅝		16⅝	16⅝			16⅝
Oct.		16⅝		16⅝	16⅝	16⅝	16⅝		16⅝	16⅝	16⅝		16⅝	16⅝	16⅝	16⅝	16⅝	16⅝		16⅝	16⅝			16⅝	16⅝	16⅝		16⅝	16⅝			16⅝
Nov.		17⅛		17⅛	17⅛	17⅛	17⅛		17⅛	17⅛	17⅛		17⅛	17⅛	17⅛	17⅛	17⅛	17⅛		17⅛	17⅛			17⅛	17⅛	17⅛		17⅛	17⅛			17⅛
Dec.		18⅝		18⅝	18⅝	18⅝	18⅝		18⅝	18⅝	18⅝		18⅝	18⅝	18⅝	18⅝	18⅝	18⅝		18⅝	18⅝			18⅝	18⅝	18⅝		18⅝	18⅝			18⅝
1937																																
Jan.				20⅜	20⅜	21⅜			22⅛		22⅜	22⅛	22		21⅛	21⅛	21⅛	21⅛		21⅛	20⅛		20⅜			21⅛	21⅛	21⅛		21⅜	21⅜
Feb.		21		21⅞	21⅞	21½			21¼		21½	21⅛			21⅛	21⅛	21⅛	21⅛		21⅛	20⅛		20⅜			21⅛	21⅛	21⅛		21⅜	21⅜
Mar.		21⅞		21⅞	22½	22½			22⅝		23⅛	23⅛			23⅝	23⅝	23⅝	23⅝		23⅝	23⅝		24⅜			24⅜	24⅜	24⅜		24⅜	24⅜
April		26⅛		26⅛	25⅛	25⅛	24⅛		24⅛		24⅛	23⅛			24⅛	24⅛	24⅛	24⅛		24⅛	24⅛		24⅛			25⅛	25⅛	25⅛		26½	24⅞

Average Spot Closing Prices—Ribbed Smoked Sheets

(New York Market)

Average Price per Pound for Years 1910-1929

Year	Cents	Year	Cents	Year	Cents	Year	Cents	Year	Cents
1910	206.60	1914	65.33	1918	60.15	1922	17.50	1926	48.50
1911	141.30	1915	65.85	1919	48.70	1923	29.45	1927	37.72
1912	121.60	1916	72.50	1920	36.30	1924	26.20	1928	22.48
1913	82.04	1917	72.23	1921	16.36	1925	72.46	1929	20.55

Average Monthly Price per Pound Since 1930

	1930 Cents	1931 Cents	1932 Cents	1933 Cents	1934 Cents	1935 Cents	1936 Cents	1937 Cents
Jan.	15.24	8.34	4.38	3.08	9.32	13.10	14.35	21.37
Feb.	15.85	7.70	4.03	2.95	10.45	12.92	15.48	21.33
Mar.	15.34	7.71	3.35	3.01	11.01	11.51	15.89	24.09
Apr.	14.93	6.43	3.02	3.56	12.10	11.55	15.98	
May	14.24	6.49	3.09	4.95	13.26	12.05	15.62	
June	12.45	6.35	2.66	6.15	13.51	12.57	15.85	
July	11.24	6.37	2.89	8.01	14.60	12.10	16.49	
Aug.	9.96	5.38	3.63	7.31	15.47	11.98	16.25	
Sept.	8.28	5.08	3.84	7.30	15.36	11.55	16.46	
Oct.	8.20	4.87	3.65	7.64	13.96	12.62	16.55	
Nov.	9.01	4.65	3.44	8.66	13.04	13.15	17.97	
Dec.	9.05	4.64	3.24	8.87	12.98	13.28	20.01	
Average for Year	11.98	6.17	3.49	5.96	12.92	12.37	16.41	

London Closing Prices of Ribbed Smoked Sheets

(In Pence Per Pound)

Day	1937 Jan.	1937 Feb.	1937 Mar.	1937 Apr.	Day	1937 Jan.	1937 Feb.	1937 Mar.	1937 Apr.
1	——	10 3/16	10 3/4	13 3/16	17	——	10 1/2	12 3/8	
2	——	10 1/8	10 3/4	13	18	10 1/2	10 3/16	12 5/16	
3	——	10 3/16	10 3/4	13 1/16	19	10 1/4	10 1/16	12 1/4	
4	9 3/4	10 3/16	10 3/4	——	20	10 1/16	10 1/16	12 1/16	
5	10	10 1/2	10 5/16	12 1/16	21	10 1/16	——	——	
6	10 7/16	10 5/16	11 1/16	12 5/16	22	10 1/8	10 1/2	12 1/16	
7	10 3/8	——	——	12 1/16	23	10 1/16	10 1/2	12 1/16	
8	10 7/16	10 3/16	11 1/4	12 7/16	24	——	10 5/16	12 1/16	
9	10 5/16	10 7/16	11 3/16	11 13/16	25	10 1/4	10 13/16	12 3/16	
10	——	10 1/2	11 3/16	12 1/16	26	10 1/2	10 3/4	——	
11	10 1/4	10 5/8	11 1/2		27	10 1/4	10 13/16	——	
12	10 1/4	10 5/8	11 7/16		28	10 3/16	——	——	
13	10 3/4	10 5/8	11 1/2		29	10 3/16	——	——	
14	10 1/4	——	——		30	10 3/16	——	13 3/16	
15	10 3/4	10 1/2	11 5/8		31	——	——	13 1/4	
16	10 5/8	10 3/16	12 1/4						

Average Monthly Price Per Pound

Month	1934 Pence	1935 Pence	1936 Pence	1937 Pence	Month	1934 Pence	1935 Pence	1936 Pence	1937 Pence
Jan.	4.429	6.434	6.758	10.378	Aug.	7.401	5.696	7.581	
Feb.	4.920	6.292	7.255	10.503	Sept.	7.409	5.508	7.577	
Mar.	5.136	5.745	7.450	11.766	Oct.	6.806	6.130	7.898	
Apr.	5.712	5.604	7.502		Nov.	6.294	6.308	8.572	
May	6.207	5.822	7.335		Dec.	6.295	6.340	9.580	
June	6.245	6.027	7.352		Average for				
July	7.053	5.801	7.696		Year	6.159	5.976	7.713	

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market)

Recent Daily Price Per Pound

Date	1937 Feb.	1937 Mar.	1937 Apr.	Date	1937 Feb.	1937 Mar.	1937 Apr.	Date	1937 Feb.	1937 Mar.	1937 Apr.
1	13.29	13.50	15.17	11	13.17	14.45		22	——	14.66	
2	13.25	13.60	14.98	12	——	14.47		23	13.08	14.54	
3	13.30	13.87	15.06	13	13.11	14.54		24	13.18	14.63	
4	13.25	13.84	——	14	——	——		25	13.20	14.55	
5	13.20	14.01	15.08	15	13.15	14.85		26	13.27	——	
6	13.21	14.18	14.96	16	13.06	15.00		27	13.34	14.73	
7	——	——	14.67	17	12.98	14.88		28	——	——	
8	13.16	14.05	14.80	18	12.97	14.73		29	——	14.76	
9	13.16	14.27	14.59	19	12.96	14.50		30	——	15.25	
10	13.11	14.44	14.53	20	12.95	14.55		31	——	15.10	
				21	——	——					

Average Monthly Price Per Pound

	1934 Cents	1935 Cents	1936 Cents	1937 Cents		1934 Cents	1935 Cents	1936 Cents	1937 Cents
Jan.	11.25	12.70	11.91	13.06	Aug.	13.40	11.48	12.28	
Feb.	12.28	12.58	11.53	13.15	Sept.	13.00	10.80	12.31	
Mar.	12.30	11.63	11.43	14.46	Oct.	12.48	11.28	12.30	
Apr.	11.80	11.73	11.71		Nov.	12.53	12.01	12.23	
May	11.44	12.25	11.68		Dec.	12.76	11.99	12.83	
June	12.20	11.89	12.02		Average for				
July	12.84	12.26	13.11		Year	12.36	11.88	12.11	

World Stocks of Crude Rubber

(All figures are in long tons)

ON HAND OR AFLOAT TO THE U. S.

At End of	ON HAND 1935	ON HAND 1936	ON HAND 1937	AFLOAT 1935	AFLOAT 1936	AFLOAT 1937	ON HAND AND AFLOAT 1935	ON HAND AND AFLOAT 1936	ON HAND AND AFLOAT 1937
Jan.	349,446	285,054*	201,915	42,066	43,870	55,096	391,512	328,924*	257,011
Feb.	340,264	282,902*	193,864	42,969	46,532	53,538	383,233	329,434*	
Mar.	340,284	276,823*		44,485	58,935		384,769	335,758*	
Apr.	337,586	264,228*		37,651	47,678		375,237	311,906*	
May	322,558	248,317		44,375	48,860		366,933	297,177	
June	324,218	245,886		55,581	47,228		379,799	293,114	
July	334,692	234,498		49,018	60,343		383,710	294,841	
Aug.	334,106	229,056		47,724	63,597		381,830	292,653	
Sept.	331,121	228,477		43,413	62,240		374,534	290,717	
Oct.	322,857	219,553		49,913	67,825		371,770	287,378	
Nov.	308,993	212,515		46,588	73,691		355,581	286,206	
Dec.	303,000	218,844		39,094	56,567		342,094	275,411	

(Rubber Manufacturers' Association figures raised to 100%)

* Revised.

Note: Complete figures for 1934 and 1935 were revised by the R.M.A. on May 1, 1936.

STOCKS IN GREAT BRITAIN

(No. of Tons in Wharves and Warehouses, not including Latex)

At end of	London 1935	London 1936	London 1937	Liverpool 1935	Liverpool 1936	Liverpool 1937
January	81,807	84,791	29,005	66,405	77,188	41,895
February	87,605	79,757	26,508	67,983	77,138	37,078
March	92,664	74,779		69,218	72,823	
April	94,361	68,932		70,584	71,388	
May	95,722	61,349		71,927	69,150	
June	98,077	55,993		73,131	66,173	
July	99,226	49,575		74,915	63,715	
August	101,574	45,749		75,584	62,367	
September	101,198	44,364		76,263	59,485	
October	94,749	40,777		76,400	55,738	
November	90,542	37,495		76,301	51,184	
December	86,551	33,027		77,589	45,291	

(Figures from the Rubber Trade Association of London)

STOCKS IN OTHER CENTRES

(Figures from Statistical Bulletin of the Int'l Rubber Regulation Committee)

	Penang and Singapore [1]	Malaya [2]	Ceylon [2]	Holland	Para and Manaos
At end of 1936					
March	29,322	31,723	3,866	1,547	4,864
April	32,200	34,090	3,123	1,497	4,873
May	26,687	33,179	3,379*	1,360	4,522
June	28,260	34,166	3,057	1,070	4,502
July	29,443	34,395	3,610	1,026	4,696
August	28,289	34,849	3,961	979	1,742*
September	26,936	33,351	3,930	911	1,817
October	24,593	34,941	3,490	773	1,820
November	26,761	33,469	3,415	588	1,948
December	26,969	35,145	5,161	409	2,454
At end of 1937					
January	36,365		5,024		4,005

[1] Dealers' and Port Stocks. [2] Inside Regulated Areas. [3] Dealers' Stocks Only.
* Revised.

RUBBER STOCKS AFLOAT

End of: 1936:	Afloat for United States	Afloat for Europe	All Other * Afloat	Total * Afloat
February	46,532	18,690	19,778	85,000
March	58,935	16,820	14,245	90,000
April	47,678	17,025	18,297	83,000
May	48,860	18,670	21,470	89,000
June	47,228	20,200	22,572	90,000
July	60,343	20,300	25,357	106,000
August	63,597	19,800	15,603	99,000
September	62,240	18,090	15,670	96,000
October	67,825	20,790	17,385	106,000
November	73,691	19,270	13,039	106,000
December	56,567	24,800	21,633	103,000
End of: 1937				
January	55,096	24,920	17,984	98,000
February	53,538	20,000p	19,462	93,000

* *Total Afloat* is an arbitrary estimate based on 1½ months' shipments as adopted by the Department of Commerce. *All Other Afloat* is determined by subtracting the amount of stocks in transit to the United States and Europe from the estimated total.
P—Preliminary estimate.

TOTAL WORLD STOCKS

(Figures from the Survey of Current Business)

At end of	1932	1933	1934	1935	1936	1937
January	623,416*	634,797	661,948	698,153	600,479*	444,087
February	611,819*	626,227	663,308	686,195	599,355*	
March	614,894*	638,428	666,382	678,809	574,594*	
April	615,893*	629,159	658,796	677,006	558,583	
May	612,474*	626,537	689,239	677,569	533,411*	
June	595,712	613,055	672,804	671,525	511,931*	
July	589,037	618,258	676,200	679,061	510,873*	
August	597,274	617,449	674,702	680,644	492,439*	
September	599,986	623,683	694,361	661,509	485,488*	
October	609,368	636,597	680,616	655,000	478,190*	
November	614,342	642,968	684,408	617,300*	458,637*	
December	629,898	654,890	705,975	613,987*	448,414*	
Monthly Average	609,502*	630,171	677,395	666,397*	521,033*	

* Revised.

U. S. Tire and Tube Statistics[1]

(All Figures Represent Thousands)

AUTOMOBILE CASINGS

Figures for Recent Years

	1929	1930	1931	1932	1933	1934	1935	1936
Production	68,726	50,965	48,740	40,085	45,303	47,233	49,362	58,116
Shipments	69,395	53,638	50,061	40,251	44,094	46,687	50,183	55,363
Inventory [2]	11,838	9,003	7,775	7,644	8,888	9,455	8,196	11,114

Figures for Recent Months

	PRODUCTION 1934	PRODUCTION 1935	PRODUCTION 1936*	SHIPMENTS 1934	SHIPMENTS 1935	SHIPMENTS 1936*	INVENTORY 1934	INVENTORY 1935	INVENTORY 1936*
Jan.	3,922	4,626	4,579	3,222	3,663	3,875	9,684	10,398	8,917
Feb.	4,335	4,383	3,579	3,285	3,287	3,212	10,725	11,530	9,265
Mar.	5,180	4,346	3,640	4,223	4,204	3,857	11,651	11,675	9,087
Apr.	4,470	4,512	4,857	4,438	5,144	4,904	11,981	11,003	9,035
May	4,456	4,175	4,974	5,332	4,067	5,833	11,127	11,131	8,178
June	4,342	3,910	5,612	5,228	4,262	5,793	10,219	10,755	7,835
July	3,353	3,532	5,466	4,157	5,447	5,744	9,437	8,850	7,750
Aug.	3,533	3,993	5,017	4,308	4,739	4,977	8,697	7,805	7,799
Sept.	2,936	3,787	4,984	3,183	3,303	3,837	8,419	8,288	9,012
Oct.	3,287	4,051	5,126	3,010	4,055	4,082	8,657	8,291	10,096
Nov.	3,341	3,997	4,972	3,191	3,930	4,233	8,779	8,249	10,823
Dec.	3,778	4,051	5,311	3,109	4,081	5,016	9,455	8,196	11,114

AUTOMOBILE INNER TUBES

Figures for Recent Years

	1929	1930	1931	1932	1933	1934	1935	1936
Production	68,829	52,420	48,333	36,891	42,556	46,228	47,879	57,607
Shipments	70,592	54,938	50,021	37,911	41,391	45,046	48,067	54,626
Inventory [2]	12,807	9,999	7,922	6,749	7,815	9,180	8,231	10,985

Figures for Recent Months

	PRODUCTION 1934	PRODUCTION 1935	PRODUCTION 1936	SHIPMENTS 1934	SHIPMENTS 1935	SHIPMENTS 1936	INVENTORY 1934	INVENTORY 1935	INVENTORY 1936
Jan.	3,551	4,259	4,592	3,199	3,722	4,168	8,403	9,621	8,623
Feb.	4,078	4,171	3,556	3,323	3,362	3,446	9,167	10,466	8,699
Mar.	5,194	4,123	3,787	4,118	4,168	3,796	10,244	10,406	8,692
Apr.	4,735	4,259	4,824	4,342	4,453	4,746	10,585	10,170	8,788
May	4,359	3,892	4,819	4,902	3,451	4,919	10,043	10,615	8,719
June	4,097	3,480	5,035	5,309	4,024	5,504	8,795	10,050	8,105
July	3,531	3,251	5,177	4,323	5,269	5,758	8,053	8,005	7,725
Aug.	3,680	3,894	5,039	4,198	4,556	5,136	7,555	6,939	7,621
Sept.	3,110	4,125	5,161	3,024	3,426	4,231	7,639	7,565	8,627
Oct.	3,219	4,435	5,397	2,689	3,987	4,108	8,151	8,053	9,977
Nov.	3,169	3,942	4,739	2,767	3,687	3,995	8,503	8,161	10,732
Dec.	3,503	4,048	5,121	2,850	3,962	4,819	9,180	8,231	10,985

(1) These figures have been adjusted to represent 100% of the industry based on reports received by the Rubber Manufacturers' Association which represent 80% for 1931-1932-1933; 97% for 1934-1935; 81% for 1936. All figures through September, 1936, were revised in December, 1936. Annual figures are more accurate.
(2) Held by manufacturers at end of period indicated.
(*) Revised.

Automobile Production

	United States Total	United States Passenger Cars	United States Trucks	Canada Total	Canada Passenger Cars	Canada Trucks	Grand Total
1928	4,357,384	3,826,613	530,771	242,382	196,737	45,645	4,599,944
1929	5,358,420	4,587,400	771,020	263,295	207,498	55,797	5,621,715
1930	3,355,986	2,814,452	540,534	154,192	125,442	28,750	3,510,178
1931	2,389,730	1,973,090	416,640	82,621	63,477	19,144	2,472,351
1932	1,370,678	1,135,493	235,187	60,816	50,718	10,098	1,431,494
1933*	1,920,057	1,573,512	346,545	65,924	53,855	12,069	1,992,126
1934*	2,753,111	2,177,919	575,192	116,852	92,647	24,205	2,869,963
1935*	3,946,934	3,252,244	694,690	172,877	135,562	37,315	4,119,811
1936	4,454,535	3,676,063	778,472	162,322	131,308	31,014	4,616,857
1936							
April	502,775	417,133	85,642	24,951	20,247	4,704	527,726
May	460,565	385,507	75,058	20,006	16,389	3,617	480,571
June*	452,955	375,894	77,061	16,400	13,126	3,274	469,355
July	440,999	372,402	68,597	10,475	8,192	2,283	451,474
August	271,291	209,754	61,537	4,660	3,051	1,609	275,951
Sept.	135,130	90,597	44,533	4,655	2,481	2,174	139,785
Oct.	224,628	190,688	33,940	5,361	4,592	769	229,989
Nov.	394,890	341,456	53,434	10,812	10,086	726	405,702
Dec.	498,721	426,019	72,702	20,411	16,542	3,869	519,132
1937							
Jan.	379,843	309,594	70,249	19,583	15,009	4,574	399,426
Feb.	363,930	296,487	67,443	19,707	14,415	5,292	383,637
Mar.							

* Revised.
Note: U. S. figures represent factory sales; Canadian figures represent production.

Exports of Crude Rubber from Principal Producing Countries

(Long Tons)

	BRITISH MALAYA [1]								DUTCH EAST INDIES [1]						
	Gross Exports	Imports	Gross Exports Minus Imports	Ceylon [2]	India & Burma [3]	Sarawak [4]	British North Borneo [5]	Siam [4]	Java & Madura	Sumatra E. Coast	Other D.E.I.	Indo-China [5]	Amazon Valley	All Other [6]	World Total [7]
1923	252,016	70,432	181,584	39,971	6,416	5,705	4,237	1,718	32,930	46,344	57,822	5,067	16,765	7,856	406,415
1924	259,706	108,524	151,182	39,997	7,697	6,699	4,621	2,962	42,446	54,497	80,347	6,688	23,165	9,065	429,366
1925	316,825	158,022	158,803	49,566	10,082	5,424	5,377	5,377	46,757	65,499	120,626	7,881	25,298	13,797	514,487
1926	391,328	151,243	240,085	58,962	9,874	9,155	6,079	4,027	52,186	71,413	121,231	8,203	24,298	16,017	621,530
1927	371,322	182,845	188,477	55,356	11,321	10,923	6,582	5,472	55,297	77,815	142,171	8,645	28,782	15,633	606,474
1928	409,430	149,787	259,643	57,267	10,790	10,087	6,698	4,813	58,848	82,511	121,770	9,548	21,129	10,690	653,794
1929	574,836	163,092	411,744	81,584	11,663	11,077	7,381	5,018	65,990	87,789	134,037	9,696	21,148	6,767	853,894
1930	547,043	133,876	413,167	76,970	10,782	10,309	6,781	4,251	69,755	79,396	115,254	7,665	14,260	5,651	814,241
1931	519,740	125,506	394,234	61,769	8,470	10,451	6,247	4,218	75,952	87,747	116,009	11,696	12,121	3,294	792,203
1932	478,252	92,539	385,713	48,973	3,888	6,960	4,664	3,451	61,312	79,837	85,871	13,883	6,450	1,816	702,818
1933	573,412	167,377	406,035	63,351	4,527	10,874	7,555	7,765	73,851	91,861	149,659	18,394	9,883	2,737	846,312
1934	677,361	211,803	465,558	79,746	10,492	17,233	11,103	17,545	87,400	112,058	175,470	20,170	8,903	2,985	1,008,663
1935	590,319	174,652	415,667	54,316	13,968	19,465	8,885	28,327	57,488	78,325	139,297	28,816	11,275	8,745	864,574
1936	520,286	167,799	352,487	49,692	14,724	21,243	8,177	33,702	61,307	84,577	152,205	40,782	14,193	11,466	845,431
1935:															
May	51,353	23,720	27,633	4,473	1,084	1,977	848	2,752	6,217	7,930	21,541	2,365	832	718	78,370
June	49,751	18,637	31,114	3,525	1,101	1,983	603	2,869	5,698	8,281	14,416	2,048	659	714	73,011
July	48,975	11,257	37,718	4,106	766	1,752	1,164	1,729	5,909	5,663	8,664	1,939	427	709	70,546
Aug.	51,873	10,978	40,895	5,683	565	772	566	2,328	4,660	6,923	9,087	2,433	1,150	725	75,787
Sept.	51,247	10,365	40,882	4,053	710	1,758	421	1,949	4,089	5,862	9,637	2,601	1,121	669	73,752
Oct.	48,258	19,364	28,894	5,932	1,284	1,684	1,040	2,679	3,937	6,711	16,818	2,260	1,292	714	73,245
Nov.	43,147	10,518	32,629	4,288	2,273	1,141	455	2,303	3,724	3,818	8,863	2,445	907	876	63,722
Dec.	37,838	7,529	30,309	4,942	3,028	1,233	171	3,079	3,881	5,206	3,854	4,532	1,352	1,122	62,709
1936:															
Jan.	39,101	12,582	26,519	4,178	1,299	2,317	938	1,665	4,315	6,347	9,381	2,449	1,606	839	61,853
Feb.	38,436	18,857	19,579	3,664	1,382	2,107	529	3,663	4,789	6,643	15,851	2,892	1,201	1,051	63,353
Mar.	46,552	12,026	34,526	4,336	1,324	1,848	342	2,966	4,484	5,052	9,225	2,553	1,264	751	68,671
Apr.	36,251	14,702	21,549	3,172	1,230	2,053	869	1,596	4,895	6,446	13,032	2,416	1,056	947	59,261
May	46,568	12,527	34,041	2,560	1,117	2,354	517	2,077	4,258	6,015	10,766	2,281	956	776	67,718
June	40,049	15,026	25,023	3,766	1,226	1,386	461	3,737	4,577	6,519	14,588	2,733	917	823	65,756
July	53,114	19,038	34,076	3,773	1,359	1,399	1,035	3,734	6,133	8,578	17,946	2,738	964	933	82,668
Aug.	43,506	13,361	30,145	3,940	776	2,541	656	3,284	4,978	7,353	12,106	3,017	542	1,054	70,392
Sept.	44,110	10,039	34,071	5,367	664	1,139	537	3,259	4,531	6,241	10,175	3,505	1,119	937	71,545
Oct.	46,543	12,960	33,583	5,599	1,181	2,143	1,086	3,349	6,477	8,145	12,881	3,874	1,255	1,105	80,678
Nov.	47,342	16,923	30,419	4,960	1,322	1,950	701	2,260	5,398	7,109	16,718	3,872	1,592	1,163	77,464
Dec.	38,714	9,758	28,956	4,377	1,844		506	2,988	6,472	10,129	9,536	8,450	1,721	1,087	76,072
1937:															
Jan.	41,571	16,956	24,615	4,541	1,077	4,063	1,234	3,849	5,136	8,011	12,888	2,828	1,271	1,000*	70,513
Feb.	38,058	14,048	24,010	5,619	1,831	2,043	790	3,554				3,074	1,729		
Mar.	59,568	19,579	39,989	7,066											

(1) Malayan net exports cannot be taken as production, since imported rubber is largely wet native rubber, which is reduced about one-third in weight by remilling; rubber exported as latex is not included which on a basis of 3½ pounds per gallon amounted to 115 tons in 1923, 1,117 in 1924, 3,618 in 1925, 3,263 in 1926, 2,439 in 1927, 1,437 in 1928, 2,670 in 1929, and 1,274 in 1930. (2) Ceylon Chamber of Commerce statistics until 1926; rubber exported as latex is not included—such shipments were equivalent to 18 tons in 1923, 93 tons in 1924, 6 tons in 1925, 20 tons in 1926, about ½ ton in 1927, and 1 ton in 1928, and practically none in 1929, 1930 and 1931. (3) Official statistics. (4) Imports into Singapore and Penang. (5) Exports from "Other D.E.I." are chiefly wet native rubber, which is reduced about one-third in weight by remilling; rubber exported as latex is not included which on a basis of 3½ pounds per gallon amounted to 2,342 tons in 1923, 1,008 tons in 1924, 2,239 tons in 1925, 44 tons in 1926, 84 tons in 1927, 1,459 tons in 1928, 1,302 tons in 1929, and 2,656 tons in 1930. (6) Calculated from official import statistics of principal consuming countries, viz., United States, United Kingdom, France, Germany, Belgium and Netherlands, and includes guayule rubber. (7) This total includes the third column for British Malaya, "Gross Exports minus Imports," and all the figures shown for the other territories. * Figure is provisional: final figure will be shown when available

NOTE: ANNUAL FIGURES ARE MORE ACCURATE; THEY ARE REVISED AT THE END OF THE FOLLOWING YEAR.

Net Imports of Crude Rubber into Principal Manufacturing Countries

(*Long Tons*)

	United States [1]	United Kingdom	France (h)	Germany	Canada (ac)	Japan (da)	Italy	Russia (ce)	Australia (cd)	Belgium (d)	Netherlands	Scandinavia (abcdf)	Spain (g)	Czechoslovakia (abcd)	World Total
1919	238,407	42,671	17,685	5,584	6,395	9,753	9,894	75	1,002	3,995	2,771	3,149	2,418	9	343,808
1920	249,530	56,844	13,885	11,890	11,746	5,297	6,123	62	1,815	3,840	5,510	2,292	2,008	567	371,409
1921	179,736	42,087	15,135	21,920	8,124	21,713	3,906	165	1,014	1,705	1,022	1,279	2,245	569	300,620
1922	296,594	11,724	24,352	27,546	9,207	15,934	6,430	2,493	2,643	172	—3,807	1,778	589	567	396,222
1923	301,527	12,700	27,392	18,519	13,277	15,372	8,489	2,986	1,649	2,184	792	2,528	630	1,128	409,173
1924	319,103	—11,550	30,446	22,727	14,299	19,571	8,764	2,346	3,124	2,688	—807	3,178	944	1,370	416,203
1925	385,596	4,061	32,956	33,937	19,683	11,117	11,412	7,088	4,757	2,930	875	3,149	1,155	1,558	520,274
1926	399,981	84,865	34,240	22,775	20,229	18,125	9,809	6,529	9,021	2,498	2,670	4,046	1,299	1,870	617,957
1927	403,472	60,249	34,271	38,892	26,405	20,521	11,381	12,018	9,490	6,482	636	4,224	2,055	2,672	632,768
1928	407,572	4,846	36,498	37,855	30,447	25,621	12,433	15,134	8,430	7,958	2,243	4,418	3,178	3,138	599,771
1929	528,608	122,675	55,093	49,275	35,453	34,284	17,169	11,774	15,886	9,445	3,022	6,440	864	4,650	894,638
1930	458,036	120,069	68,503	45,488	28,793	33,039	18,639	16,387	5,354	10,635	2,924	7,710	2,400	4,468	822,445
1931	475,993	86,170	46,466	39,688	25,261	43,483	10,149	30,671	7,649	11,009	2,220	6,360	2,605	7,717	794,641
1932	393,844	44,086	42,506	45,121	20,917	56,027	14,469	30,637	12,576	9,519	2,851	7,262	4,359	9,444	693,618
1933	398,365	73,335	61,953	54,120	19,332	66,831	19,341	29,830	13,534	11,166	1,243	7,831	5,520	10,402	772,803
1934	439,172	158,482	49,560	59,330	28,439	69,905	21,398	47,271	9,642	9,115	3,758	12,418	6,900	10,999	926,389
1935	455,758	128,829	51,450	62,899	26,870	57,567	21,880	37,572	9,978	7,593	4,068	11,878	8,140	11,245	895,727
1936	475,359	—2,591	57,032	71,794	27,871	61,223	17,000*	30,541	14,109	9,648	2,888	11,236	6,668	8,772	791,550
1935:															
Oct.	35,770	3,184	5,175	6,074	812	4,727	2,500*	4,876	829	539	671	1,000	597	742	67,496
Nov.	25,756	2,942	4,731	6,258	4,389	4,361	2,000*	4,859	783	449	245	1,206	1,044	1,276	60,298
Dec.	38,072	4,779	5,522	4,823	2,567	6,112	2,500*	4,906	1,019	1,074	287	1,359	750	1,466	75,236
1936:															
Jan.	33,260	4,573	6,755	5,545	1,759	4,355	1,500*	467	1,260	760	369	736	664	767	62,770
Feb.	33,789	1,271	6,264	5,257	1,900	2,786	1,000*	94	735	799	106	497	1,312	344	56,154
Mar.	33,743	—1,227	4,333	4,569	1,811	5,170	1,000*	4,376	819	1,033	339	754	1,113	410	58,243
April	44,948	2,097	4,250	5,497	1,079	4,929	1,500*	3,251	919	1,097	238	848	679	603	71,935
May	35,549	302	4,335	4,639	2,221	5,531	1,000*	4,220	1,034	698	103	657	500*	667	61,456
June	35,901	—1,493	4,846	5,698	2,042	4,567	1,500*	2,427	1,635	579	—27	650	500*	323	59,148
July	38,556	—766	4,621	6,837	2,274	5,126	2,000*	1,733	1,363	713	183	1,094	500*	495	64,729
Aug.	41,094	—1,581	4,513	6,556	3,781	4,305	1,500*	3,128	807	789	42	1,145	500*	989	67,440
Sept.	49,483	—12	4,393	6,006	2,393	5,195	1,500*	2,922	2,297	514	471	1,090	300*	624	77,176
Oct.	40,301	—87	4,752	7,232	3,110	6,600	1,500*	2,761	1,092	817	343	1,171	200*	1,026	70,818
Nov.	37,897	—742	3,282	6,500	4,308	3,961	1,500*	2,162	964	1,090	445	1,388	200*	823	63,778
Dec.	50,838	—4,926	4,688	7,458	1,193	8,698	1,500*	3,000*	1,184	759	276	1,206	200*	1,701	77,775
1937:															
Jan.	48,744	33	4,690	7,041	1,632	8,357	1,500*	3,000*	582		269	1,115	200*	567	
Feb.	50,282	—222		7,911		6,630			304		245				

a—Including gutta percha. b—Including balata. c—Re-exports not deducted in monthly statistics. d—Including some scrap and reclaimed rubber. e—Official statistics of rubber imports by Soviet Russia. f—Including Norway, Sweden, Denmark and Finland. g—United Kingdom and French exports to Spain except in years prior to 1925. h—French imports have been reduced 12 per cent in order to eliminate imports of gutta percha and to reduce to basis of net weight. [1] United States imports of guayule are included in this compilation. * Figure is provisional; final figure will be shown when available.

NOTE: ANNUAL FIGURES ARE MORE ACCURATE; THEY ARE REVISED AT THE END OF THE FOLLOWING YEAR.

The WHERE-TO-BUY Section of THE RUBBER AGE in which are listed the Products and Services of the Leading Suppliers to the Industry.

The Market Place

If what you are seeking is not listed here, write to the Service Department of THE RUBBER AGE, 250 West 57th St., New York, N. Y.

Chemicals and Compounding Materials

ACCELERATORS—
Ureka C—Ureka Blend B—Ureka.—A-1, A-7, A-11, A-16, A-19, A-32, Z-88, A-510, DPG
ANTIOXIDANTS — Flectol A, Oxynone
MONSANTO CHEMICAL CO.
Rubber Service Laboratories Div.
1012 Second National Bldg., Akron, Ohio

AERO BRAND
RUBBER CHEMICALS
DPG—DOTG—Accelerator 49
Rubber Sulphur
American Cyanamid & Chemical Corporation
30 Rockefeller Plaza, New York, N. Y.

ALUMINUM FLAKE
A uniform, fine, low gravity, white reinforcing pigment. *Furnished to the rubber trade for 25 years.*
The Aluminum Flake Co.
Akron, Ohio

ANTIMONY Pentasulphide. golden and crimson. very fine. pure.
Rare Metal Products Co.
Belleville, N. J.
Direct Factory Representation

ASBESTINE—Specially prepared for use in Rubber. Send for liberal working samples.
SOLE PRODUCERS
International Pulp Co.
41 Park Row New York City

CALCENE—The Ideal low gravity, white reinforcing pigment. Gives high tensile and elongation properties with exceptionally good resistance to tear and abrasion.
The Columbia Alkali Corporation
BARBERTON, OHIO

CARBON BLACK—*Micronex*
the world's standard gas black. universally known as the "King of Rubber Pigments."
Binney & Smith Co.
41 East 42nd St. New York City

RATES
for Listings in this Section

●

$5.00 per listing per month.

10% Discount if 2 listings per month are used.

15% Discount for 3 or more listings per month.

Copy Subject to Style Regulations.

No cuts accepted.

CARBON BLACK—*Aerflotex*
Arrow Black for rubber compounding. Standard for grit-free uniformity.
J. M. Huber, Inc.
460 West 34th St. New York

CARBON BLACK
SUPREME—*the up-to-date standard for rubber*
Imperial Oil & Gas Products Co.
Grant Building, Pittsburgh, Pa.

CARBON BLACK
DIXIE...KOSMOS
Used throughout the world
UNITED CARBON COMPANY
Charleston, W. Va.
New York • Akron • Chicago

CARBON BLACK
DISPERSO . . . *the specially developed Carbon Black that gives* BETTER DISPERSION.
WISHNICK-TUMPEER, INC.
295 Madison Ave., New York

CATALPO—The universal and standard rubber pigment now being used in treads, solids, tubes, carcass frictions, etc.
Moore & Munger
33 Rector Street, New York City

CHEMICALS
Carbon Black—Clay
Accelerators—Sulphur
Stocks Carried At All Times
Ernest Jacoby & Co.
79 Milk St. Boston, Mass.
Cable Address: Jacobite Boston

CHEMICALS
For Rubber: *Accelerators, Antioxidants, Specialties*
For Industry Generally: *Acids, Aniline Oil, Latex, Latol, Dispersions*
NAUGATUCK CHEMICAL
Div. of U. S. Rubber Products, Inc.
1790 BROADWAY NEW YORK

CHEMICALS and Mineral
Ingredients—Whiting, Clay, Tale, Barytes, Colors. Heavy Calcined Magnesia. Carbonate of Magnesia, Pumice Stone.
Standard Since 1890
Whittaker, Clark & Daniels, Inc.
260 West Broadway New York

COLLOIDAL SULPHUR
COLLOIDAL ZINC OXIDE
COLLOIDAL COLORS
HEVEATEX CORPORATION
78 Goodyear Ave., Melrose, Mass.
Offices in New York, Akron, Chicago

COLORS—*for Rubber*
Fine organic colors—Reds, Blues, Oranges, Violets, Greens—or any shade to meet your requirements—also Rubber Dispersed Colors
Ansbacher-Siegle Corporation
Rosenbank, Staten Island, N. Y.
820 So. Clinton St., Chicago, Ill.
Agents in Principal Cities

COLORS
BRILLIANT ORGANIC DYES; PERMANENT, NON-BLEEDING, LOW COST For All Cures
MONSANTO CHEMICAL CO.
Rubber Service Laboratories Div.
1012 Second National Building
Akron. Ohio

THE MARKET PLACE Section Continued on Next Page